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THE YEAR-BOOK OF THE DEPARTMENT OF AGRICULTURE.

This Year-book has been issued and distributed to the members of the various agricultural associations of the Colony. It follows the lines of the Year-book issued in the previous year and includes articles specially prepared by members of the Department of Agriculture.

Soil erosion is briefly dealt with and the attention of agriculturists drawn to the methods which can be employed to prevent this loss of soil and fertility on old estates, in new clearings and in unalienated lands.

Under Tea, the control of Tea termites is dealt with, and this article should be of practical value to tea estates on which this problem is becoming increasingly more important year by year.

The growth and yield in Hevea is summarized under Rubber and the conclusion that yield is an inherent character independent of vegetative vigour is one of importance. Evidence has been secured which indicates that a rubber tree is, in general, born a good yielder or a bad yielder, and no special cultivation or treatment will convert a poor yielder into a good one. High yielders may, however, as the result of disease or unfavourable soil and climatic conditions become mediocre or even poor yielders and cultivation and manuring should be directed towards the maintenance of trees in normal conditions of health and growth. The results of a Brown bast census are also given and should be of interest to rubber growers.

Under Coconuts, further details are given of continued observations on nut-fall. It is concluded that the inability of certain palms to carry their nuts to maturity is an inherent

character and is not in all cases the result of fungus diseases or of adverse environmental conditions. An illustrated account is also given of some abnormalities in coconuts which have been sent to the Department during the year.

The results of the trials with different methods of planting paddy are analysed in detail and should be studied by those interested in the improvement of paddy cultivation.

Under Fibres, the results of experiments with cotton, rozelle and sisal are given whilst under Fodders the results of the trials at Peradeniya and Jaffna Experiment Stations are fully discussed.

Details of further experience with green manures and cover plants at the Experiment Station, Peradeniya, are given. The yields which have been obtained from *Gliricidia maculata* as a green manure in tea should prove to be of interest to those who have made trials with this plant, while the details given regarding other green manure plants should be of general interest.

Other articles include a description of the soft-rot of vanilla, an account of the plantain-root beetle-borer, an emergency method of applying spray-fluids, a preliminary account of the rats which cause losses to the agriculturist and a brief account of the Indian glowworm which is a predator on the African or Kalutara snail.

The irrigation of crops in the Jaffna peninsula is also fully dealt with and illustrations given of the well-sweep, the Persian wheel or Noria and Stoney's pattern of the Double Mhote.

A brief account of the earlier work in connection with the improvement of chillies by selection on the Jaffna Experiment Station is also included, and coloured illustrations given of some of the types which have been isolated for further experimental work.

The first issue of this Year-book of the Department of Agriculture was appreciated by agriculturists and its favourable reception has been a source of great encouragement to all members of the staff. The second issue, covering as it does the work of 1923, is now in the hands of the agricultural public and it is hoped that it will be found to be of value and assistance.

RUBBER.

REPORT ON RUBBER TAPPING EXPERIMENTS, 1923.

PERADENIYA EXPERIMENT STATION.

T. H. HOLLAND, M.S.E.A.C.,
Manager, Experiment Station, Peradeniya.

The old two-vs. three-day tapping trials—Plots 151—154.

The following table gives the yields obtained in this experiment from the time of commencement up to the end of 1923.

Year	Two day Tapping yields per tree. Series 1 lb. oz.	Series 3 lb. oz.	Series 5 lb. oz.	Av. of 3 series lb. oz.	Three-day Tapping yields per tree. Series 2 lb. oz.	Series 4 lb. oz.	Series 6 lb. oz.	Av. of 3 series lb. oz.	Percentage of 2-day tapping Yield
1919	3' 2	3'4	3' 4	3'3	2' 5	2' 4	2 8	2' 6	73'6%
1920	3'12	3 7	3' 7	3'8	2' 7	2'10	2'8	2' 8	70'9%
1921	4' 3	4'2	4' 5	4'3	2'15	2'12	3'3	2'15	69'6
1922	4' 0	4'5	5' 1	4'7	3' 4	3' 5	4'3	3'11	71'3
1923	3' 9	4'7	4'13	4'4	1'15	2' 6	3'1	2 7	57'5
Total	18'10	19'9	20'14	19'9	12'14	13' 5	15'7	13'15	71'12

In 1923 the trees tapped on alternate days received 173 tappings while these on every third day received only 112 owing to wet days.

180 trees within narrow limits of girth dimensions were originally included in the experiment. 12 trees have subsequently been lost chiefly from *Fomes lignosus*, 8 trees among those tapped on alternate days and 4 trees among those tapped on every third day. The first tapping cut in all cases was a single cut to the left at 30 inches from the ground at an angle of $22\frac{1}{2}^{\circ}$ on the half circumference. There is no change over till the bottom of the panel is reached. The alternate day tapping cut was first changed over to the top of a new panel in February 1922 and the three-day tapping cut in July 1923. This throws some light on the comparative yields for 1921, 1922, and 1923. After the change in February 1922 the increase in yield per tree over 1921 for the trees tapped on alternate days was only 3 oz., while the increase in the case of the trees tapped every three days, where no change had taken place, was 12 ozs. Also the percentage of the two-day tapping yield obtained by the trees tapped every third day was 71'3% compared with 69'6% in 1921. In 1923 a general decrease in yield is noted which is due largely to the wet season; the increase is proportionately larger in the trees tapped every three day, partly owing to the wet weather encountered

on the days when these trees were due to be tapped. The remarkable falling off in Series 2 calls for special attention; it is in this area that most of the losses from Fomes have occurred; several of the trees have recently shown a marked diminution in yield, possibly indicating a diseased condition; it may be necessary to exclude this series from future comparison. In the trees tapped every two days 5·8 % of the trees are showing possible symptoms of Brown Bast, against 1·1 % in the trees tapped every third day. 22 trees of those tapped every two days were slightly affected with Bark rot and 11 trees among those tapped on every third day. No difference can be noted in the bark renewal in the different methods of tapping. The allowance of bark was 8 in. for the trees tapped on alternate days and 5 in. for those tapped every third day; the actual consumption averaged 7½ in. and 4 5/6 in. The proportion of dry rubber (less scrap) to latex was 39·0 o/o in the alternate day and 39·6 % in the three-day tapping.

HILL-TOP RUBBER.

Three simultaneous and overlapping experiments are in progress in this area :—

1. Comparison of three methods of planting
2. Comparison of V cut with single cut.
3. New 2- vs 3-day tapping experiment.

1. Comparison of three methods of planting.

Tapping in this area was started in April 1922 and the following table gives the yields and the other data from the time of commencement to the end of 1923 of those trees only which are tapped with a single cut on alternate days :—

No. of block	Method of tapping	No. of trees per acre.	Av. girth of trees Jany. 1914.	Yield per tree for whole period. lb. oz.	Calculated yield per acre for whole period. lb. oz.	Nature of land
				lb. oz.		
A	Clumps of 4 trees 12 ft. × 12 ft. with 40 ft. between clumps.	69	33·33	6· 2	422·10	Sloping
B	Avenues, trees 15 ft. × 12 ft. with 40 ft. between avenues.	112	34·12	4· 0	448· 0	Flat
C	20 ft. × 20 ft. on the square	109	32·69	4·15	538· 3	Steep and rocky.

The yields of the trees widely spaced in clumps claim attention. The growth of the trees as measured by girth would appear to follow the nature of the land rather than the method of planting. All the above trees are tapped with single cut to the left at an angle of 16_o starting at 24 inches from the ground. In addition to the lie of the land the fact that the trees in Block C are tapped by a different man to those in Blocks A and B renders comparison of yields difficult.

COMPARISON OF V CUT AND SINGLE CUT.

Half the trees in Block A (clumps) and half in Block B (avenues) are tapped with single cut to the left at 16° and half with a single V cut, both on the half circumference and on alternate days throughout the year. 152 trees are tapped on each system. The following table gives the yields per tree to date :—

Year.	*Single Cut.* Block A	Block B	Average	*V. Cut.* Block A	Block B	Average
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
1922 April to December	2 7	1 12	2 1	2 5	1 12	2 0
1923	3 11	2 4	3 7	4 0	2 12	3 6
Total	6 2	4 0	5 8	6 5	4 8	5 6

All the trees are tapped by one man.

The results so far do not indicate any advantage in the V cut as far as yield is concerned. A similar conclusion was indicated from experiments carried out in plots 80 and 81 in 1914.

The bark renewal in this block is perhaps the best on the station; that of the trees tapped with the V cut appears slightly more vigorous than that of the trees tapped with a single cut. The average bark consumption was $7\frac{1}{2}$ inches in the V cuts and $7\frac{1}{3}$ inches in the single cuts. The average proportion of dry rubber (less scrap) to latex is 30·9% in the V cuts and 32·0% in the single cuts.

NEW 2- VS. 3-DAY TAPPING TRIALS.

The difference between this experiment and the other experiment in progress in plots 151–154 is that in this case the cuts on the trees tapped every three days were started at 16 in. from the ground i.e., two-thirds of the height (24 inches) at which the cut on the trees tapped on alternate days were started. The experiment is in progress in Block C. of the Hill-top rubber which as stated is on fairly steep and rocky land.

The block is divided into 6 series, Series 1, 3 and 5 being tapped on alternate days and Series 2, 4 and 6 on every third day. The method is throughout one cut to the left at 16° on the half circumference. Two tappers are employed but their tasks are changed round periodically to equalise the personal factor. The following table gives the yields from the commencement of the experiments :—

Year.	*Two-day Tapping.* Series 1	Series 3	Series 5	Av. of 3 series	*Three-day Tapping.* Series 2	Series 4	Series 6	Av. of 3 Series	% of two-day tapping yield
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	
1922 April to December	2 2	2 3	1 13	2 1	1 10	1 9	1 9	1 9	75·7
1923	3 0	3 2	2 10	2 15	2 10	2 4	2 10	2 8	85·1
Total	5 2	5 5	4 7	5 0	4 4	3 13	4 3	4 1	81·1

It will be noted that the percentages in the last column are higher than any obtained in the old experiment in plots 151–154, even in the year 1922, when the two-day tapping cut in that experiment had been changed to the top of a new panel. In 1923 the larger percentage in the Hill-top rubber is partly accounted for by the fact that the trees tapped every three days in that experiment received 116 tappings while owing to the accidental distribution of wet days those in plots 151–154 received only 112 tappings. The trees tapped on alternate days received 173 tappings in each case.

Again, for some reason the full bark allowance of 5 inches was utilised in the three-day tapping while 7½ inches out of the allowance of 8 inches was utilised in the alternate day-tapping.

53 trees of those tapped on alternate days were slightly affected with bark rot and 40 trees of those tapped every three days. Only one tree in Block C. is showing Brown Bast symptoms. The bark renewal appears about equal in the two methods of tapping; in comparing series 5 and 6 the renewal appears superior in the two-day tapping but in the case of series 1 and 2 the position is reversed, and the differences can be accounted for in the lie of the land. The proportion of dry rubber (less scrap) to latex was 31·2% in the alternate-day tapping and 32% in the three-day tapping.

THE HILLSIDE RUBBER.

Tapping on Alternate-days throughout the Year vs. Tapping Daily in Alternate Months.

This block of 7½ acres is divided into six series two of which are tapped on alternate days throughout the year, two daily in January, March, May etc., and two daily in February, April, June, etc. The method in all cases is a single cut to the left at 16° starting at 24 inches from the ground on the half circumference. The trees selected for tapping are within narrow limits of girth measurement and all are tapped by one man. Tapping commenced on April 7th, 1922, but the yields in the following table are given from June 1922 giving 4 tapping months for each of the daily tapped series.

	Alternate-day tapping.			*Daily tapping January, March, May, etc.*			*Daily tapping, February April, June, etc.*		
Year	Series 1	Series 6	Av'ge.	Series 2	Series 4	Average	Series 3	Series 5	Average
	lb. oz.	lb. oz.	lb. oz.	lb oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
1922 June to December	1 14	1 14	1 14	1 13	2 0	1 14	1 15	1 15	1 15
1923	3 8	3 0	3 4	3 0	3 3	3 2	2 14	3 0	2 15
Total	5 6	4 14	5 2	4 13	5 3	5 0	4 13	4 15	4 14

The yield is slightly in favour of the alternate-day tapping. Moreover a census of trees showing Brown Bast symptoms taken in December gave the following figures :—

Among the trees tapped daily on alternate months 16 trees showed positive symptoms while 17 further trees had gone dry and were regarded as likely to develop Brown Bast. If these dry trees are included a total of 13% affected trees is reached against 4% of the trees tapped on alternate days. The bark renewal however appears superior in the trees tapped daily on alternate months.

RUBBER RESEARCH SCHEME, CEYLON.

The following are the remarks of Mr. F. A. Stockdale, Director of Agriculture, at the Annual General Meeting of the above Scheme, held at Kandy, on March 13th, 1924. A summary of the reports of Technical Officers of the Scheme will be published in a subsequent issue :

On behalf of the Executive Committee of the Ceylon Rubber Research Scheme it is my pleasure to present their Report for the year 1923. The report has been in the hands of all Subscribers to the Scheme for some days and I need therefore only refer but briefly to its contents.

This is the second Annual General Meeting of the Scheme since reorganisation and I am glad to be able to report another year of solid progress. The value of the Scheme to the industry can be judged by the interest the industry takes in it and by the work which its officers have carried out.

The interest that the industry is taking in the Scheme is shown by the increase in Membership. Fifty-two new subscribers joined the Scheme in 1923 and since the beginning of this year a further twelve have joined—bringing the number of Rubber Growers' Association Members to 101 and the number of local Subscribers up to a total of 86. The rubber acreage represented in the Scheme is now 65% of the total rubber in Ceylon and 87% of the rubber owned by European capital. I hope that during the present year Ceylonese owners of rubber will support the Scheme and will take full advantage of the work of its officers. At present the only Ceylonese subscribers are the Hon'ble Sir H. M. Fernando and Mr. C. E. A. Dias. The latter takes a very live interest in the scientific work of the officers of the Scheme and the Executive Committee propose to invite him to join that Committee as a representative of Ceylonese interests. I look forward with confidence to increasing Membership during the year and to the time when the whole Industry will contribute to its support.

Regarding the work of the officers I would refer subscribers to the detailed reports which have been printed.

The work of Mr. Mitchell during his visits to estates has been very useful and I have had transmitted to me by Agents and Directors of Companies several expressions of appreciation of his full and informative reports. Mr. Mitchell has paid visits to 81 estates during the year and has dealt with disease and cultural problems in the field and with difficulties in the factory. He has emphasized the necessity of paying attention to Brown Bast and has given many practical demonstrations in regard to its treatment. This disease is also having the special detailed study of the Physiological Botanist, Mr. Taylor. You will have the opportunity of hearing from him to-day the result of his observations in Ceylon, Malaya and Java. The cause of this disease is still obscure, but its investigation is proceeding on sound lines.

Mr. O'Brien has carried out during the year an important series of investigations on the preservation of latex and the results of this research are published in Bulletin No. 32 which will be distributed in a few days and will be of value to all interested in the Rubber Industry. He has begun

preliminary investigations on the disinfectant action of smoke on sheet and has co-operated with the Mycologist in the investigation of "Rust." The result of this work confirms previous investigations made in Java as to the cause of this defect of sheet rubber and the means of checking it have been found to be simple. Mr. Park has also studied in detail the secondary leaf fall and pod disease of rubber and has started a series of manurial experiments to determine the effect, if any, of manure on the incidence of this disease. He has also carried out further experiments to ascertain the effect of preventive disinfectants upon Bark Rot. Last year the penetration of different disinfectants were studied and this work is being followed up now by a study of the effect of the disinfectants on the disease itself and the results obtained so far are worthy of examination. Mr. Park reverts to his post of Assistant Mycologist in the Department of Agriculture from January 1st this year and steps are being taken to secure a Mycologist for the Scheme in his place.

During last year, special emphasis was laid on the possibilities of budding rubber. Further work in this connection has been done and Mr. Taylor will be in a position to summarize to-day the position in Java. There is belief in Java scientific circles that the budding of rubber is likely to play an important part in the distant future of the rubber industry, but the results of early tappings have not come up to the expectations of the practical men in the industry. It is necessary that further detailed experimental work should be carried out. This work will be entrusted to Mr. Taylor who will make studies of union of scion and stock, influence of stock on scion, value of different trees for bud wood and the growth of different budded plants. I personally think that the Scheme should concentrate upon the budding of rubber and make the fullest investigations possible. I do not adopt the attitude which has been accepted in some quarters that absolute dependence should be had for our future plantations on seedling stocks—whether selected or not. Similarly I desire to emphasize the effect that secondary leaf fall may have on the Industry in Ceylon, and plead for its most careful study not only from scientific workers, but also from all rubber estate Superintendents and Visiting Agents. Experiments on the effect of manuring on this disease are now being made by many estates. In this connection the Rubber Research Scheme would welcome details of any results which may be considered as being of possible value to the Industry as a whole.

The work of the Technical Officers of the Scheme and the formulation of new lines of work have been examined throughout the year by the Technical Committee and I desire to convey the thanks of the Scheme to those gentlemen who have assisted it with their knowledge and advice and to welcome to this Technical Committee during the present year Mr. Roy Bertrand of Govinna Estate.

The Accounts of the Scheme have been audited, and are clearly set out at the end of the Report. The year under review has seen the adjustment of salaries to officers to scales of salaries adopted by Government for Technical Officers in the Department of Agriculture. It has also seen the erection of a new laboratory on Culloden Estate and in this connection the thanks of the Scheme are due to Messrs. Wilkins and O'Brien for general

supervision over the work of construction and erection of fittings. Government has increased its grant to Rs. 67,500 to the Scheme during the year, consequent upon the increased subscriptions from local subscribers. In the Executive Committee Report the amount of local subscription is given as Rs. 18,069 whereas in the accounts this sum is represented as Rs. 159 recovered in 1923 which had been included in the 1922 statement, Rs. 16,700 included in the Income and Expenditure Account and Rs. 1,210 paid in 1923 on account of the year 1924. The Executive Committee estimated the subscriptions from local Members at Rs. 20,000 for 1924 but anticipated that a sum less than this might be received on account of loss on exchange. It is, however, gratifying to be able to report that up to date a sum of Rs. 21,750 has been received this year and a further Rs. 1,300 is due in July next. Your Executive Committee have decided to build two bungalows during the current year for the Technical Officers stationed at Culloden, paying for one out of the current year's revenue and for the other by means of a transfer from the General Reserve Account. It has also decided to issue circulars quarterly embodying the progress of the work of officers of the Scheme regularly to all subscribers. An amount of Rs. 10,360 has been transferred to a special Reserve Account for passages and bonuses and a further Rs. 10,000 will be set aside during this year to the same Fund. You will also observe that liberal depreciation has been written off the various properties belonging to the Scheme.

Details of the investigations at the Imperial Institute are given in a separate annexure as they were not received in sufficient time for incorporation in the General Report. The principal investigation is a continuation of the study of the variability of plantation rubber. Two interim reports have already been issued and two others are in the press. Tests of rubber prepared from preserved latex have also been made and technical trials by the Kaye's Rubber Latex Process Ltd., carried out with latex preserved with Ammonia and Caustic Soda. The preparation of rubber samples in Ceylon has been under the supervision of Technical Officers in Ceylon.

The London Committee had a balance of £ 826-0-3 in hand at the end of the year.

What effect the changes of the constitution of the Imperial Institute will have on the work in London cannot yet be ascertained. This matter is however being taken up by the London Advisory Committee and has already been under consideration of the Executive Committee to-day. I personally shall be proceeding to England in June and I have placed my services, in connection with the solution of this unforeseen difficulty, at the disposal of your Executive Committee. I may mention that I have had advantage of discussions recently with Mr. G. H. Golledge, one of the representatives of Ceylon Planting Interests on the London Advisory Committee. He gave me details of the work in London and was impressed with the progress that has been made in Ceylon in the past few years. For this progress the thanks of the Scheme are due to the staff who have worked whole-heartedly for the interests of the Scheme and of the rubber industry in general. That the results of this work is appreciated is evidenced by the desire of the Tea and Coconut Industries to establish Research Schemes of a similar nature to that of the Rubber Research Scheme whose work for the past year I am now reviewing. If the plantation industries of Ceylon are to progress, scientific

research work they must have and it is gratifying to all scientific workers in Ceylon to find that the industries recognise the importance of such work and are volunteering to contribute on a share basis with Government in the provision of funds for this work.

Gentlemen, I thank you for your attendance here to-day and in conclusion I desire to express the thanks of the Scheme to the Chamber of Commerce for the use of its room in Colombo for Meetings, the Planters' Association for the use of this Hall to-day and to our Auditor for his careful scrutiny of accounts.

I move the adoption of the Reports of the Executive Committee and the Annual Statement of Accounts and Balance Sheet as audited and would invite any Members to comment thereon.

EXPERIMENTAL TAPPING ON HEVEA-BUDDINGS.

By DR. C. HEUSSER.

SUMMARY.

The buddings, of which the tapping results are communicated, are planted in different small gardens and were all tapped by the same tapper. The tapping system was one left cut under an angle of 30° over half the circumference of the tree at 50 c.m. above the union between scion and stock. The buildings were tapped during 20 consecutive days. The daily production of each tree was determined as dry rubber. Besides the production, the circumference of the trees at 1 M. above the ground and the length of the tapping cuts were also measured, and at the height of the tapping cut a sample of the bark was examined for its thickness and the number of its latex vessels. The largest number of the trees were wintering for the first time during the experiment, so that the obtained production data will not be flattered with regard to weather variations.

The characteristics of the mother trees and buddings are treated successively in the paper, dividing them into two groups, A. and B. according to how they fulfilled the expectations, while the buddings in the seed garden Perdagangan are treated in group C.

The experiment gave the following results: confirming those of VISCHER.*

1. The experimental tappings have shown convincingly that the production power of the buddings of one and the same clone is uniform and increases proportionally with the increase of the dimensions of the plant (trunk circumference : thickness of the bark and number of latex vessels).

2. That the vegetative off-spring of the examined mother trees show great differences in quality.

It is proved, as already stated by VISCHER that there are high yielding rubber trees possessing this property through heredity and not through external conditions only.

They guarantee that the selection of Hevea will have a future, applied either vegetatively or generatively.

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* Archief 1922, 416.

An examination of illegitimate seedlings from good mother trees show their production power to be very different.

By comparing the tapping results of the illegitimate seedlings with the buddings of the mother trees 33, 35, and 36, the conclusion is arrived at that buddings will be better than illegitimate seedlings. It is however not improbable that legitimate seedlings will be even better if obtained by a good cross-pollination or by self-fertilisation.

A budding is an artificial product and therefore disturbances will always be present, at the union between scion and stock, which may be profitable as well as detrimental for stock and bud. They are the internal causes of a number of external phenomena of the Hevea buddings, such as elephant foot, the cylindric shape of the budding and the phenomenon first found by Grantham, that the production of the budding falls back as the cut approaches the stock.

The bark thickness of the buddings at a height of ½ M. seems to be slightly thinner than that of seedlings; it is however very constant, also regarding the number of latex vessel rows, to a height of more than 1 M.

The renewal of the bark of buddings up to the present gave no reason for complaints. Hevea buddings show a very striking abundant fertility, a phenomenon also observed with other plants and generally used by the European fruit cultivation.

It is expected that the stock will always have a detrimental influence on the production of the budding and that we will probably not be able to obtain the same production as from the normal mother tree.

An individually marked influence of the stock on the shape of the budding could not yet be observed; the buddings show a very good resemblance regarding ramification and crown formation and in this manner the characteristics of the mother tree are often recognised.

For practical purposes the following conclusions are of importance:—

There are mother trees whose buddings give unsatisfactory production. Thus be careful with the selection of your mother trees.

The quality of a mother tree for budding purposes can only be determined with security from the tapping results of its buddings. Thus, for budding purposes on the estates use only budding wood of trees (or buddings from those trees) whose buddings have been tapped with good results.

Regarding our knowledge about the budding problem it is worth considering:

a. to mix well the planting of the buddings of the different mother trees or if one wants to be more cautious:

b. to plant the buddings and the seedlings of selected seed in alternate rows using a planting system of for instance 18 x 18 feet so as to allow thinning out of the small yielders of seedlings and the undesirable buddings.

Planting gardens with buddings must be considered a temporary measure; as the seed selection becomes sufficiently advanced to enable us to provide seeds of practically hereditarily good strain, the old generative propagation will be applied once more.—Archief Voor de Rubbercultuur, 8e Jaargang No. 1.

COCONUT.

VARIETIES OF COCONUTS.

Several countries have begun investigations of the varieties of coconuts and some have begun collecting data as to the yields of individual palms of their different types. It is being found that individual palms may vary considerably in their yields of nuts and it is to be expected that plantations grown from selected palms which regularly give high yields would be more profitable than plantations established with but little care and without any proper selection of seed nuts.

A preliminary investigation of some of the varieties of coconuts in Ceylon has been begun in co-operation with MUDALIYAR A. E. RAJAPAKSE on his Alexandra Estate, Jaela. There are on this property 19 types of coconuts which have been selected by MR. J. E. P. RAJAPAKSE as being distinct from each other in respect of external features, shape and size of nuts. Some of these were known to MR. RAJAPAKSE as being particularly good copra yielders and had been selected by him for planting purposes.

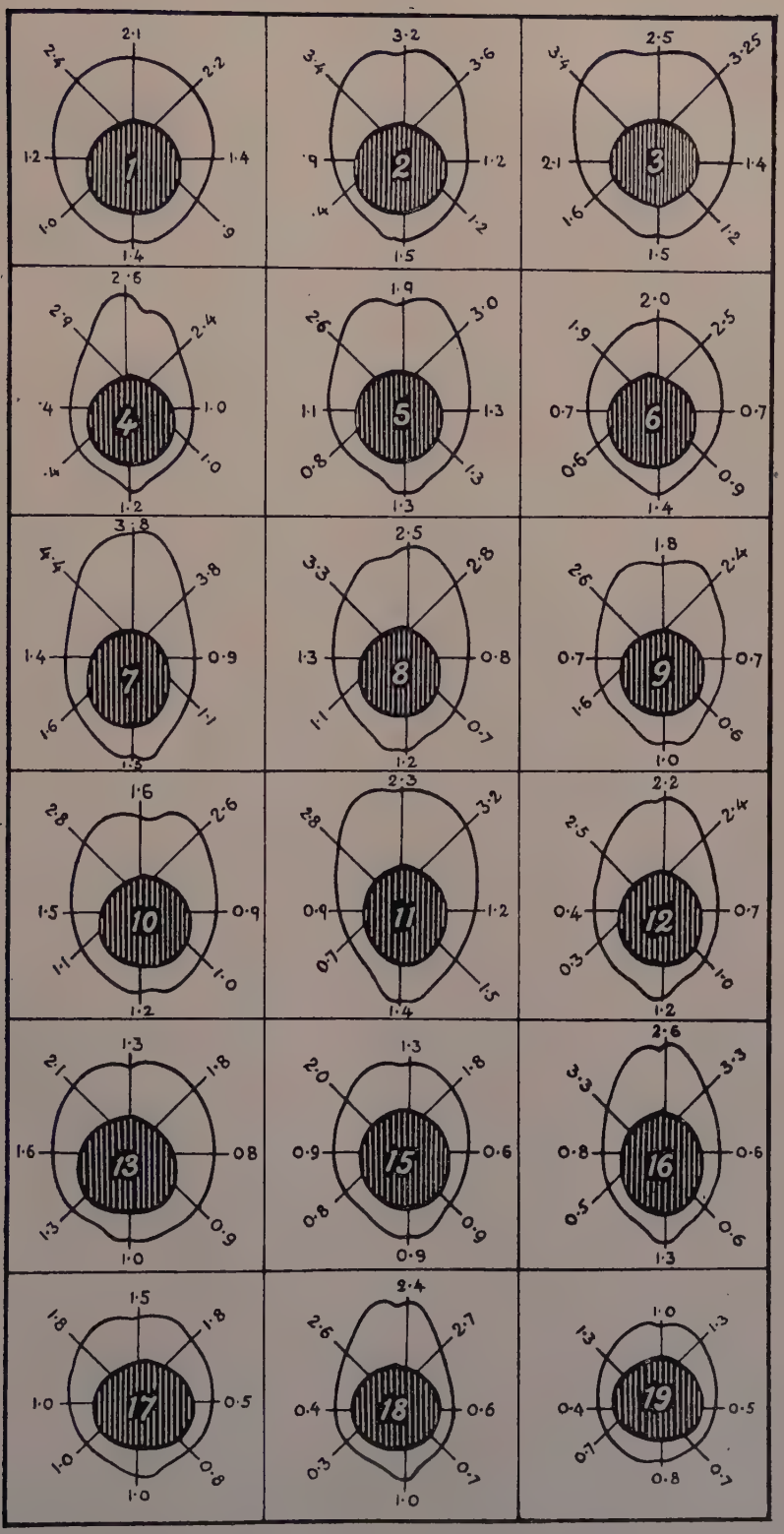
An examination of the nuts of these 19 types has been made by MR J. C. DRIEBERG, Farm School Officer, Peradeniya, and his report is as follows :—

" Four of the palms are special types, viz., the tembili or king-coconut (No. 18), the yellow gon-tembili (No. 17), a large imported nut resembling the large San Ramoa nut (No. 3), and another imported nut (No. 19).

The remaining fifteen can be grouped into 9 groups as follows :—

Group i	...	Nos. 2 and 4
ii	...	,, 5
iii	...	,, 6
iv	...	,, 12 and 16
v	...	,, 9
vi	...	,, 8 and 10
vii	...	,, 14 and 15
viii	...	,, 1 and 13
ix	...	,, 7 and 11

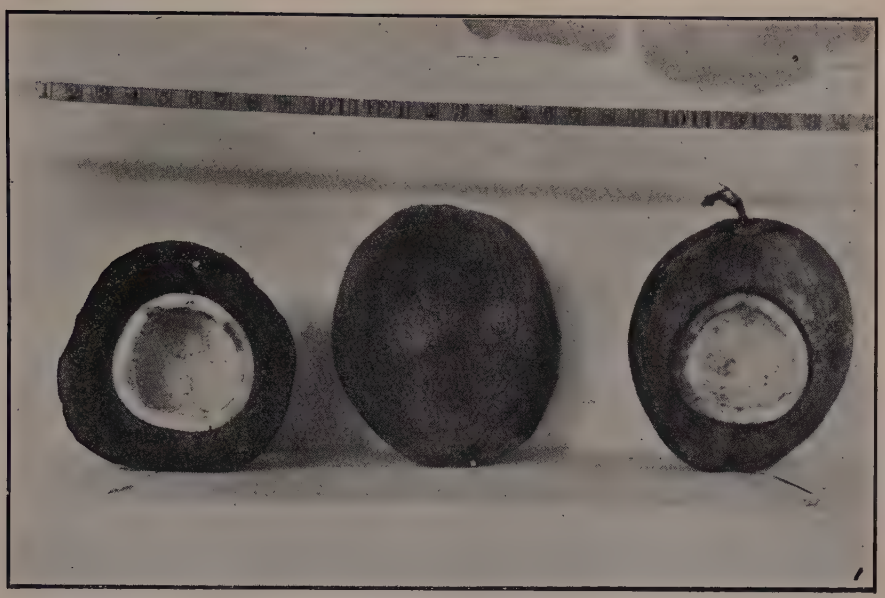
The details are given in the following pages in regard to the size and weight of the nuts grouped above



DIAGRAMS SHOWING THICKNESS OF HUSKS IN INCHES OF 19 VARIETIES OF COCONUTS.

No.		External Dimensions			Internal Dimensions			WEIGHTS										
		Circumference		Diameters and Diagonals ins.	Diameters and Diagonals ins.	Shell thickness ins.	Meat thickness ins.	Whole Nut		Husk			Shell			Meat		
		Longit. ins.	Lateral ins.					lb.	oz.	lb.	oz.	%	lb.	oz.	%	lb.	oz.	%
1	Type Nut	28·25	26·75	aa 1 12·0 bb 1 10·1 cc 1 11·8 dd 1 11·2	aa 1 8·5 bb 1 7·5 cc 1 8·5 dd 1 8·0	0·15	0·5	5	10									
	Cut Nut	27·00	25·5					5	9	2	12		0	10		1	0	17·9
2	Type Nut	29·0	23·75	aa 1 14·4 bb 1 8·1 cc 1 13·6 dd 1 13·0	aa 1 9·7 bb 1 7·0 cc 1 9·0 dd 1 9·0	0·1	0·5	4	7									
	Cut Nut	28·5	23·0					4	9	1	10		0	8		0	15	20·5
3	Type Nut	31·0	30·0	aa 1 13·0 bb 1 11·7 cc 1 14·1 dd 1 16·9	aa 1 9·0 bb 1 8·2 cc 1 9·5 dd 1 9·8	0·15	0·55	6	0									
	Cut Nut	31·0	28·25					5	2	2	12		0	12		0	14	17·0
4	Type Nut	26·0	20·5	aa 1 12·7 bb 1 7·5 cc 1 12·9 dd 1 10·6	aa 1 8·9 bb 1 6·1 cc 1 9·0 dd 1 7·8	0·15	0·55	3	5									
	Cut Nut	28·0	21·0					3	7	1	11		0	7		1	2	34·5
5	Type Nut	28·5	24·5	aa 1 12·2 bb 1 9·7 cc 1 13·8 dd 1 12·8	aa 1 9·0 bb 1 7·3 cc 1 9·6 dd 1 9·0	0·15	0·55	5	6									
	Cut Nut	28·5	24·5					5	5	3	0		0	8		1	2	21·1
6	Type Nut	25·0	21·0	aa 1 12·1 bb 1 7·8 cc 1 10·8 dd 1 11·4	aa 1 8·7 bb 1 6·4 cc 1 8·0 dd 1 8·3	0·175	0·55	4	2									
	Cut Nut	25·5	22·0					4	2	1	8		0	10		1	2	27·2
7	Type Nut	30·5	21·5	aa 1 16·0 bb 1 8·7 cc 1 16·0 dd 1 15·1	aa 1 10·7 bb 1 6·4 cc 1 10·5 dd 1 9·8	0·15	0·5	4	0									
	Cut Nut	30·25	21·25					4	6	2	10		0	11		0	12	17·1

No.	External Dimensions			Internal Dimensions			WEIGHTS										
	Circumference		Diameters and Diagonals ins.	Diameters and Diagonals ins.	Shell Thickness ins.	Meat Thickness ins.	Whole Nut		Husk			Shell			Meat		
	Longit. ins	Lateral ins.					lb.	oz.	lb.	oz.	%	lb.	oz.	%	lb.	oz	%
8 Type nut	27·0	22·25	aa 1 12·7 bb 1 9·1 cc 1 13·1 dd 1 12·7	aa 1 9·0 bb 1 7·0 cc 1 9·1 dd 1 8·8	0·15	0·5	3	12									
Cut nut	27·5	22·75					3	10	1	14		0	9		0	14	24·1
9 Type nut	24·0	19·5	aa 1 10·4 bb 1 7·4 cc 1 11·2 dd 1 10·5	aa 1 7·6 bb 1 6·0 cc 1 8·0 dd 1 7·5	0·1 0·2	0·6	3	10									
Cut nut	24·25	20·5					3	12	2	4		0	8		0	15	25·0
10 Type nut	25·5	22·75	aa 1 10·5 bb 1 9·5 cc 1 12·4 dd 1 12·1	aa 1 7·7 bb 1 7·1 cc 1 8·6 dd 1 8·4	0·15	0·5	3	15									
Cut nut	26·5	23·0					4	4	2	0		0	8		1	0	23·5
11 Type nut	26 5	21·25	aa 1 12·7 bb 1 8·6 cc 1 13·8 dd 1 12·6	aa 1 9·0 bb 1 6·5 cc 1 9·5 dd 1 8·7	0·15	0·6	3	9									
Cut nut	27·25	22·0					4	2	2	0		0	6		0	14	21·2
12 Type nut	24·5	19·5	aa 1 12·0 bb 1 7·0 cc 1 12·2 dd 1 10·5	aa 1 8·6 bb 1 5·9 cc 1 8·7 dd 1 7·8	0·15	0·5	3	2									
Cut nut	25·0	19·5					2	14	1	0		0	7		1	0	34·7
13 Type nut	22·5	22·0	aa 1 9·3 bb 1 9·6 cc 1 10·7 dd 1 10·8	aa 1 7·0 bb 1 7·2 cc 1 7·7 dd 1 7·7	0·15	0·6	3	6									
Cut nut	23·75	23·0					4	0	1	13		0	7		1	0	25·0
14 Type nut	25·0	20·75	aa 1 bb 1 cc 1 dd 1	aa 1 bb 1 cc 1 dd 1	0·15	0·55	3	12	2	0		0	8		1	0	26·6
Cut nut																	



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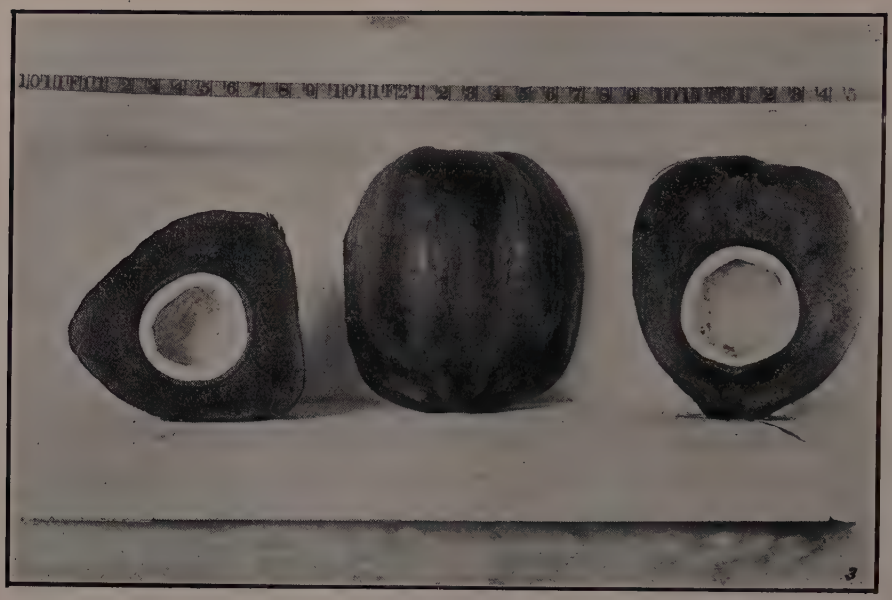

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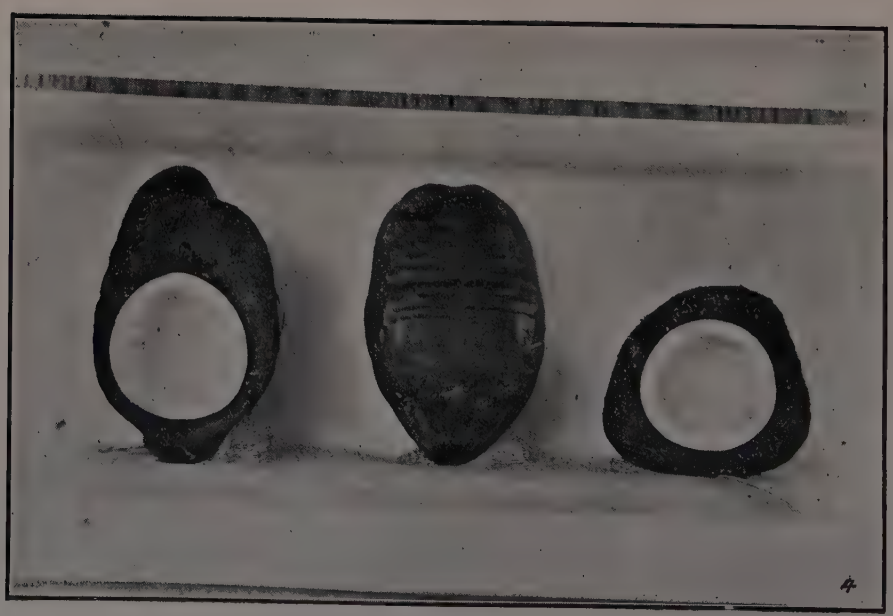

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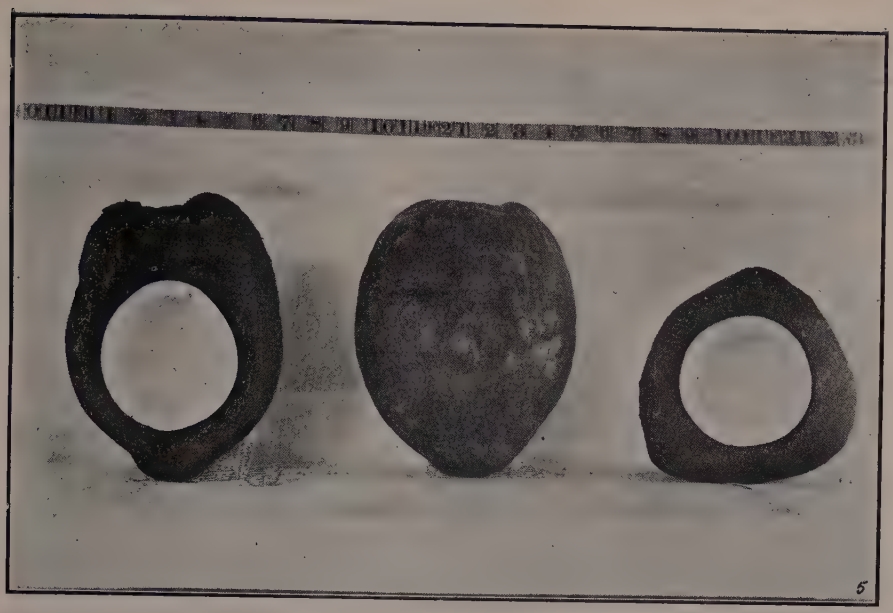

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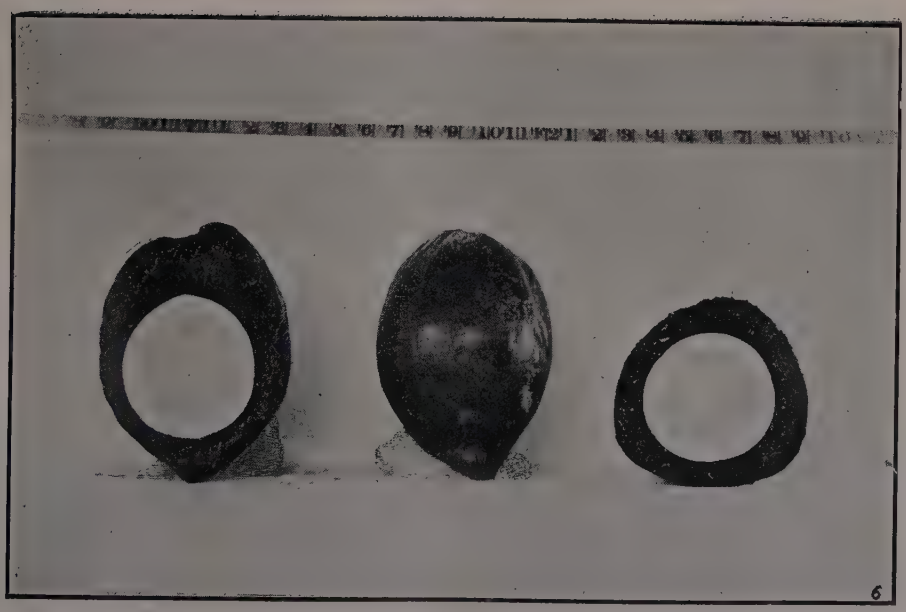

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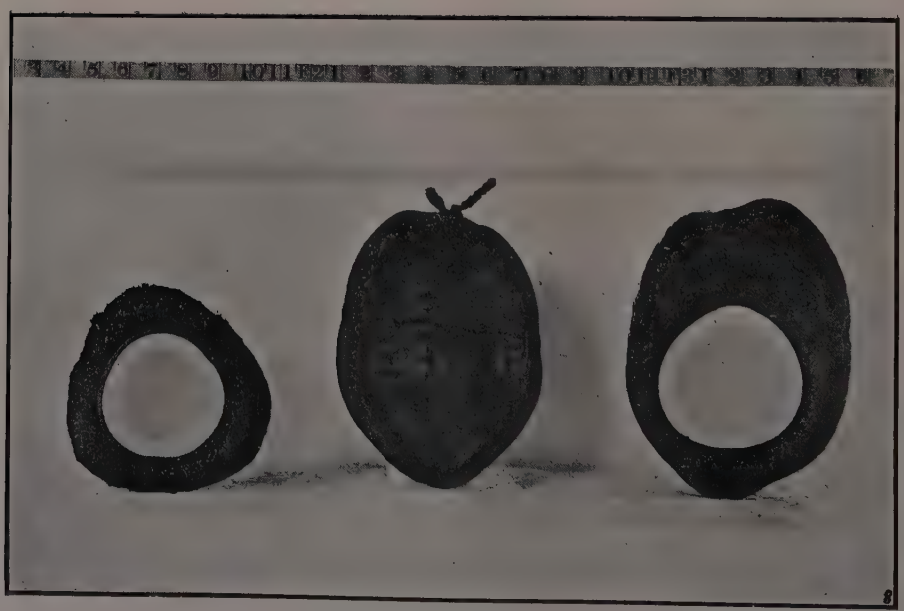


VARIETY No. 8.

No.	External Dimensions			Internal Dimensions			WEIGHTS										
	Circumferencc		Diameters and Diagonals ins.	Diameters and Diagonals ins.	Shell Thickness ins.	Meat Thickness ins.	Whole nut		Husk			Shell			Meat		
	Longit. ins.	Latera ins.					lb.	oz.	lb.	oz.	%	lb.	oz	%	lb.	oz.	%
15 Type nut	22·5	20·0	aa 1 9·6 bb 1 7·8	aa 1 7·4 bb 1 6·3			3	2									
Cut nut	23·0	20·5	cc 1 10·9 dd 1 10·1	cc 1 8·0 dd 1 7·5	0·15	0·5	3	6	1	2		0	8		1	0	29·6
16 Type nut	28·5	21·0	aa 1 13·4 bb 1 7·4	aa 1 9·5 bb 1 6·0			5	0									
Cut nut	27·0	20·25	cc 1 13·1 dd 1 12·3	cc 1 9·2 dd 1 8·5	0·125	0·5	4	8	1	4		0	8		0	14	19·4
17 Type nut	22·0	21·5	aa 1 9·5 bb 1 8·0	aa 1 7·0 bb 1 6·5			3	9									
Cut nut	22·5	21·75	cc 1 9·6 dd 1 9·3	cc 1 7·0 dd 1 6·5	0·2	0·55	3	8	2	0		0	7		0	14	25·0
18 Type nut	21·75	17·0	aa 1 11·4 bb 1 6·5	aa 1 8·0 bb 1 5·5			2	12									
Cut nut	22·0	17·5	cc 1 11·0 dd 1 10·2	cc 1 7·7 dd 1 7·2	0·1	0·5	2	11	0	14		0	5		0	12	27·9
19 Type nut	20·0	18·5	aa 1 7·6 bb 1 6·2	aa 1 5·8 bb 1 5·3			2	8									
Cut nut	19·5	18·0	cc 1 8·1 dd 1 8·0	cc 1 6·1 dd 1 6·0	0·2 0·15 0·1	0·5	2	8	0	13		0	4		0	10	25·0

COLOUR.

The following general observations have been made regarding the colour of the mature nuts:

green	Nos. 5, 9, 13, 1, 7, 11
brownish	,, 2, 12, 8, 15
brown	,, 4, 16, 10, 14
dark brown or reddish	No. 6

The question of colour, though it is a somewhat indefinite character, cannot, however, be overlooked entirely for there appears to be a general belief that seed nuts for planting in Ceylon should be of green colour. Observations on the nuts under examination show the error of this idea.

SIZE.

This is a factor somewhat difficult to gauge from the figures of girth given—or even from the photographs; but it can distinctly be observed by looking at and handling the nuts.

A determination of the *volume*, perhaps, would be a safer estimate of size. We can however discriminate between:—

large nuts	Nos. 1, 2, 4, 5, 6, 7, 8, 10
and small nuts	,, 9, 11, 12, 13, 14, 15, 16

SHAPE OF NUTS.

Some are distinctly long, while a few are round. Many must be classed as intermediate.

The long nuts are numbers 7 typical 2, 4, 8
The round nuts are ,, 13 ,, and 1

RELATIVE AMOUNTS OF KERNEL, SHELL AND HUSK.

The chief value of coconuts being their use in the preparation of copra, it is obvious that nuts with the greatest amount of kernel or meat are to be desired. In taking the weight of the fresh meat of mature nuts, the weights of the shell and husk were also taken; and the percentage of meat to the whole nut (minus water) was determined. This helps to arrange the nuts in a systematic manner according to their quality.

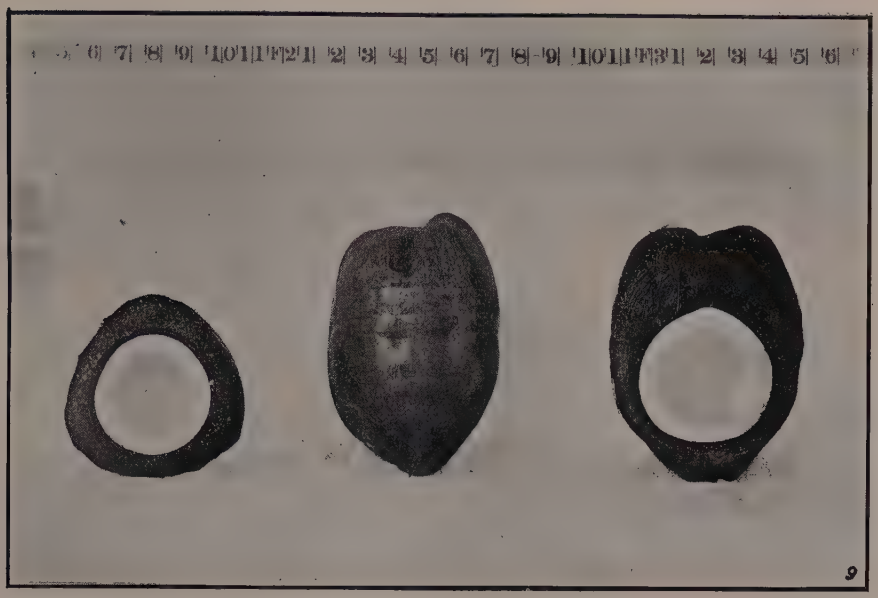
The weight of the shell scarcely varies; the weight of the kernel varies *but little*, the range being from 12 to 18 ozs.; whereas that of the husk shows a wide range from 16 to 48 ozs.

It is only when the amount of husk in a nut is considered that the precise value of any one type can be fully appreciated from the commercial point of view, for example:

				Proportion.
No. 12	shows 16 oz.	meat and 16 oz.	husk	1 : 1
,, 10	,, 16 ,,	,, 32 ,,	,,	1 : 2
,, 7	,, 12 ,,	,, 42 ,,	,,	1 : 3·5

This proportion of kernel to husk is of very considerable importance to those growers who manufacture copra only.

From the figures of analysis of the inorganic matter taken up by the different parts of the coconut (fruit) made by Lepine the proportion of the



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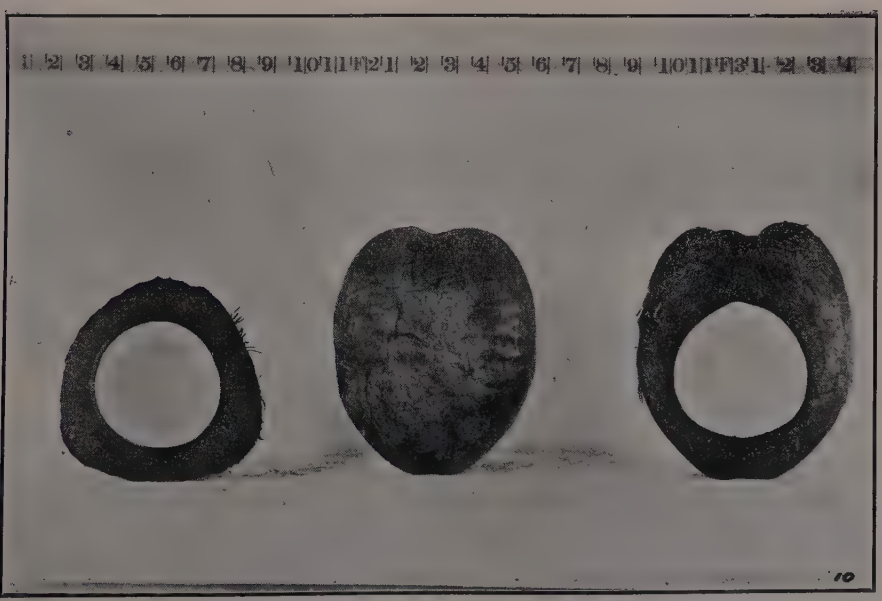

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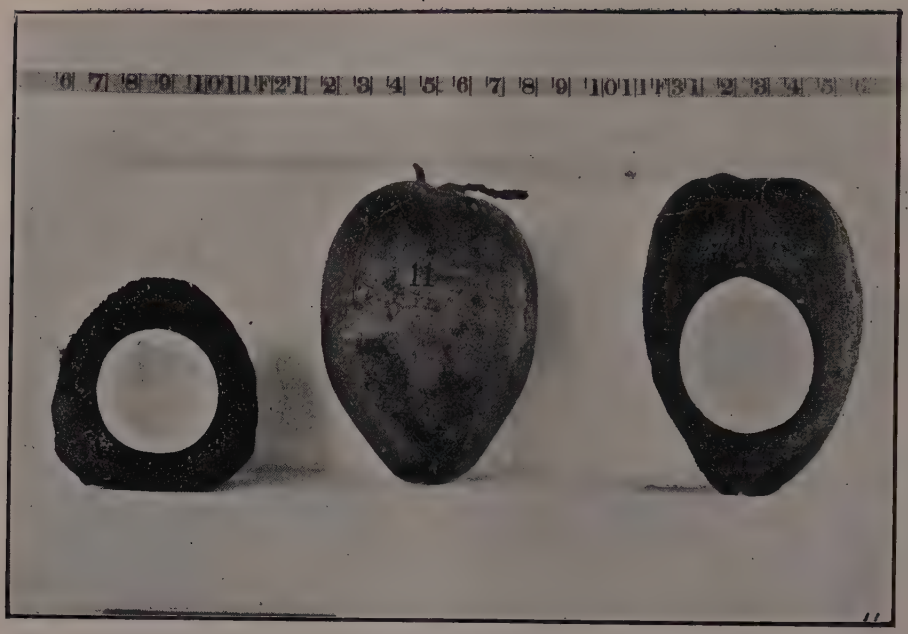

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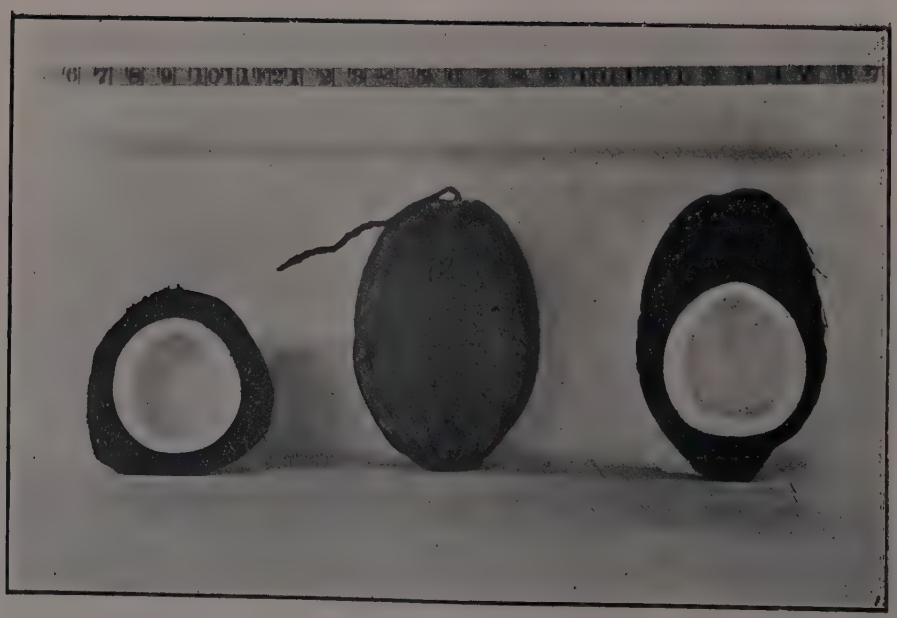

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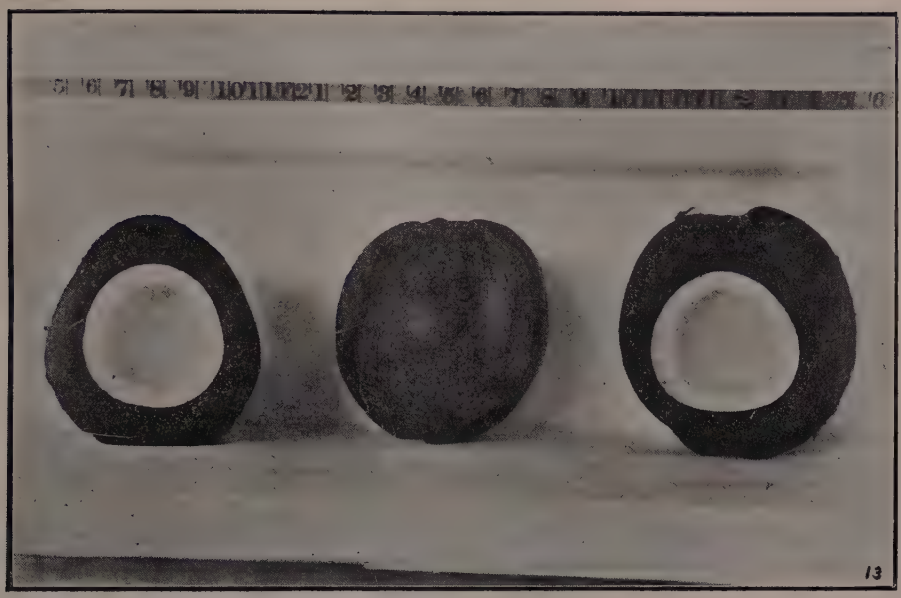

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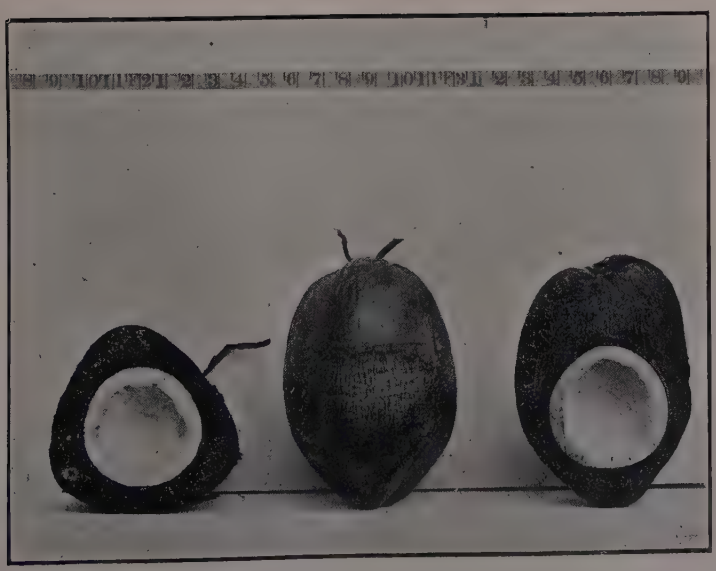

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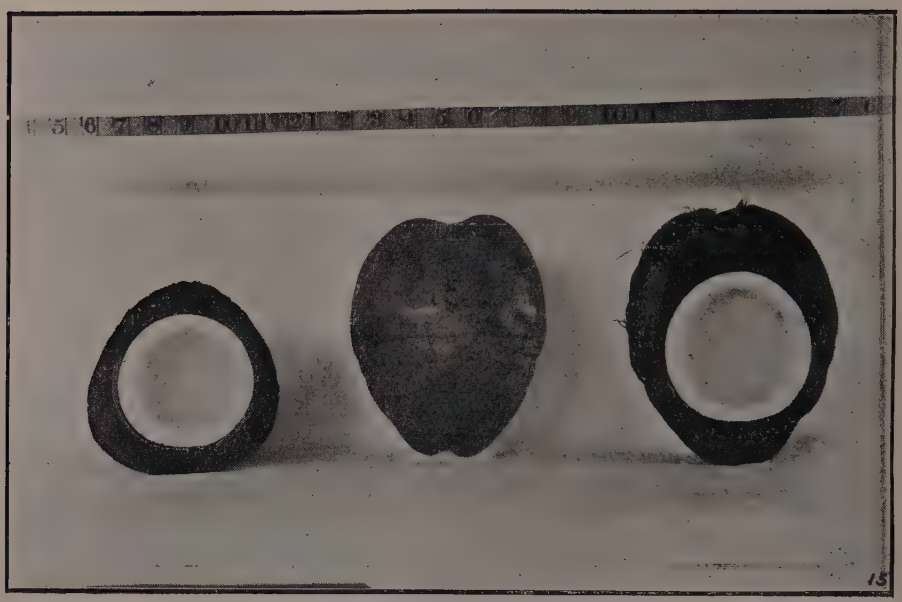

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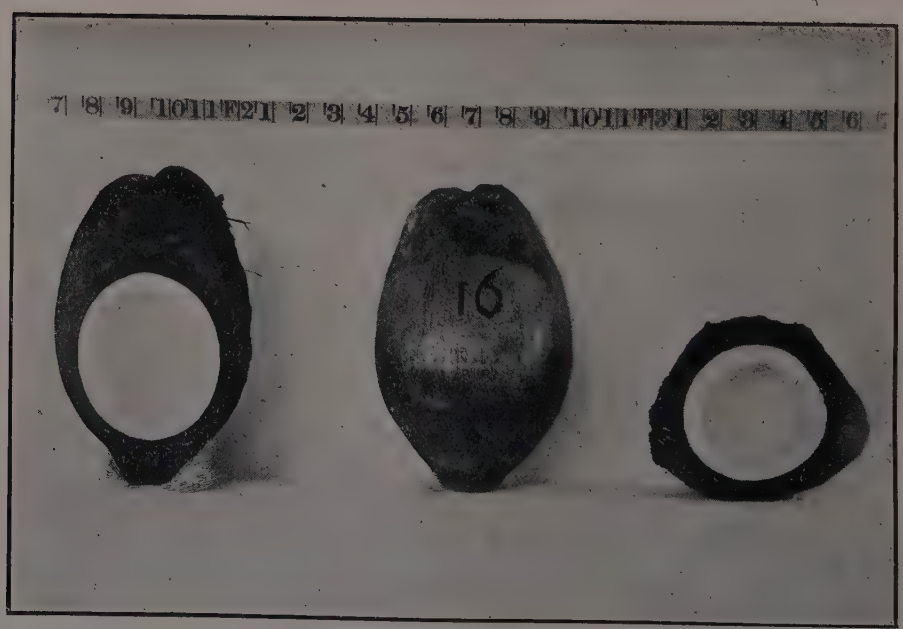

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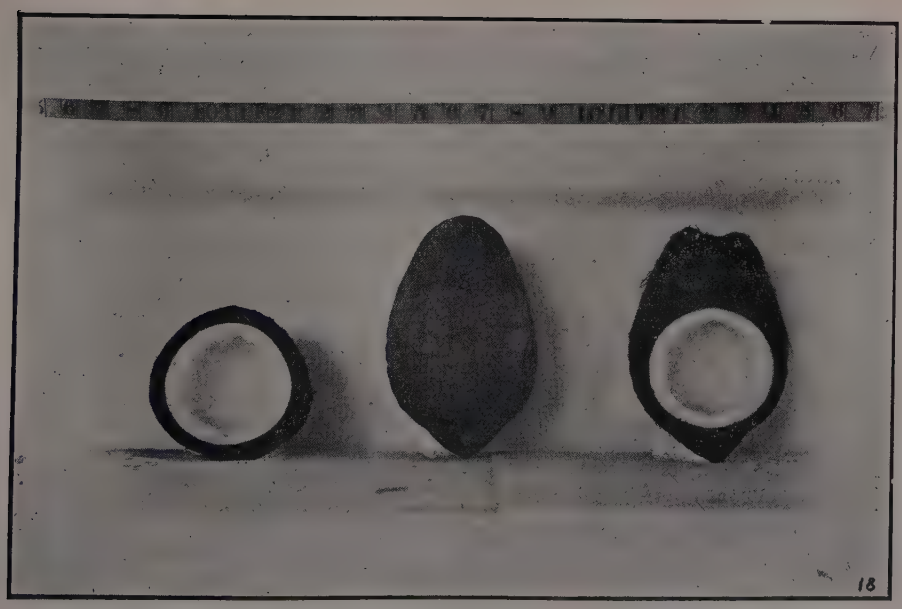

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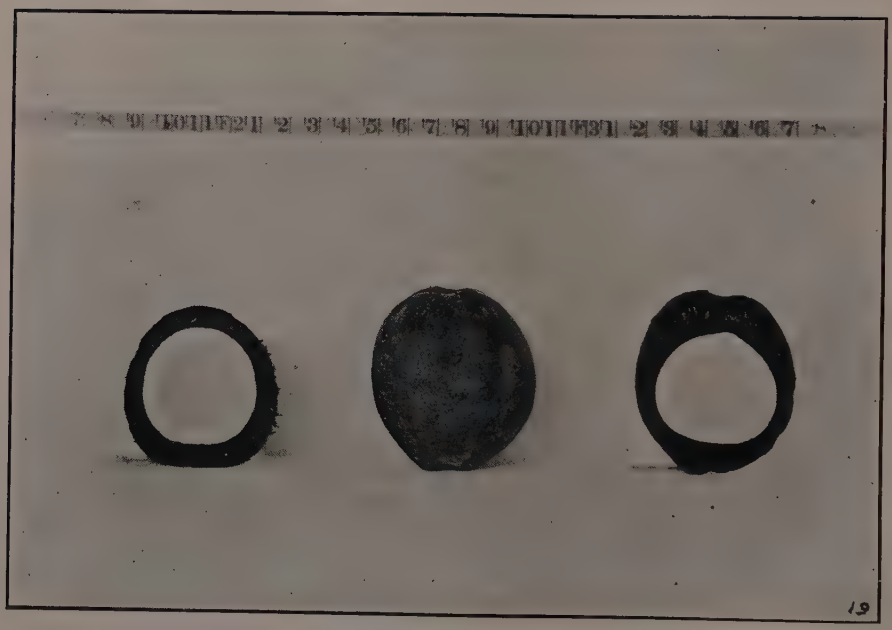

VARIETY No. 19.

important ingredients taken by the meat and the husk is as follows:

	Husk.	*Kernel.*
Salts of Potash	9½	1
Phos of Lime	1	3
Salts of Lime over	100	1

That is to say, the husk takes up as much as 9½ times the amount of Potash Salts which is absorbed by the meat, and over 100 times the amount of Lime Salts which the meat takes up.

The meat, however, uses up 3 times more of Phos. of Lime than the husk.

Thus it is obvious that the more fibrous types of nuts are to be avoided as being uneconomical feeders. This fact has been maintained by Prudhomme who states that: "nuts possessing a mesocarp which is only slightly thick should be preferred, since the fibrous coverings of the nuts take up a large part of the nutritive material absorbed by the plant."

SELECTION OF NUTS.

Can desirable nuts be known by their external features? It appears but reasonable to expect that larger nuts would possess proportionately more kernel than smaller ones; but the figures obtained do not bear this out, for it is found that the 3 best nuts, Nos. 12, 15, 16 are comparatively small beside the large sized nuts such as 1 and 7, 2 and 4. Buyers of nuts for copra-making or desiccating appear to prefer the rounder to the longer nuts, but this is only partly confirmed by observations made.

Nos. 7 and 11, 2 and 4 are long and contain a great amount of husk; but, strangely, of the best nuts, Nos. 12 and 16 also belong to the class of long nuts. This is evident from the figures of girth:

	No.	Weight girth ins:	Lateral girth ins:	Difference of length over breadth ins.
Poor nuts	7	30·25	21·25	9·00
	4	28·00	21·00	7·00
	2	28·05	23·00	5·05
	11	27·25	22·00	5·25
Good nuts	12	25·00	19·05	5·05
	16	27·00	20·25	6·75

Colour, perhaps, might offer some indication of worth? The best nuts 12 and 15 are brownish; No. 6 is reddish and Nos. 16 and 4 are brown; while the *green* nuts 5, 9, 13, 1, 7, 11 come low in the scale.

One other point with reference to the proportion of husk to meat, to which attention might be drawn is the economic aspect of manuring.

CONCLUSION.

The above are only preliminary notes made during investigation and it is not proposed for the present to make any reference to the question of particular trees or types of nuts breeding true to type.

Ten plants from each of the 19 selected trees have been put down in separate blocks by Mr. Rajapakse at Jaela; while 25 plants of each have been planted at the Experiment Station, Peradeniya, and a small number of a few of the types at the Botanic Gardens, Heneratgoda. These will serve as plots of Coconuts of known percentage on which future researches and investigations can be made.

F. A. STOCKDALE.

COTTON.

COTTON CULTURE.

BY PIETER KOCH, B.Sc., Agr.

Assistant Chief, Tobacco and Cotton Division, and Manager of the Rustenburg Experiment Station.

The cotton plant is the most important fibre plant cultivated. It has become an absolute necessity to every civilized community. The plant is grown over very extensive areas, and its cultivation and the manufacturing of its products give employment to many millions of people. From its products hundreds of necessaries are manufactured; for instance, from the fibre are made clothes, explosives, bioscope films, etc.; from the seed, oil, soap, and many other articles; from the seed-meal, animal foods, fertilizers, and dye-stuffs.

The annual world production of cotton lint is normally about 20,000,000 bales of 500 lb. each, being the quantity actually consumed in the cotton mills, and exclusive of the large amounts used locally by primitive tribes in China, India, Africa, and other countries. At present South Africa produces only a small amount of the world's supply. The farmers in this country have for many years (since about 1860) been trying to produce cotton, but until a few years ago (about 1912) their efforts met with failure owing to lack of knowledge of cultural methods and want of gins and means of conveyance. However, cotton culture has made rapid progress in recent years, especially in the middle and low veld of the Transvaal and Natal, where conditions are ideal for the crop. The future is now most promising. The great possibilities of cotton in those parts are causing wide-spread interest, and a realization of the very important part it will play in the development of the vast, sparsely populated, and fertile regions in the hotter parts of the Union. The periodical droughts to which large areas of the country are subject have further concentrated attention on this plant—when maize and other crops failed cotton grew, stood up to the trying conditions, and yielded a profitable return. Consequently, every year sees an ever-increasing acreage under cotton, so that at present many thousands of morgen are devoted exclusively to this purpose.

Botanical Features.—Botanically, cotton belongs to the Malvaceæ and falls under the genus *Gossypium*. The plant is exceedingly subject to variations, and consequently exists in a large number of forms. The chief factors influencing this tendency to variation are differences in climate, soil, environment, methods of cultivation, and hybridization. Generally it is divided into two groups, namely, the American and the Asiatic. In South Africa the first group only is grown, which includes the Upland varieties (*Gossypium hirsutum*), Sea Island (*G. barbadense*), and Egyptian cotton (*G. peruvianum*). The first of these three includes all the short and some of the long staple varieties, and is grown mostly in the Transvaal and Natal; the

second produces the best, longest, and most valuable lint, and is grown on a very small scale along the coastal regions ; the third is the cotton of Egypt, and has a beautiful, glossy appearance. This variety has been tried in several parts of the Union with varying results. An American-Egyptian variety (Pima) has given good returns under irrigation at Rustenburg. Experiments have also been conducted with a tree cotton (Caravonica), but has proved unsatisfactory.

The difference between Upland and Pima is that the latter is taller, with longer and thinner branches, much longer, deeply lobed leaves, small pointed bolls, and much later maturity. The flowers, moreover, are rich yellow in colour, with purple spots at the base, longer and finer fibres, and black, almost naked, seeds. Some Upland varieties, e.g., Wise, Peterkin, and Moss, however, also possess black, naked seeds. The fibre of Upland measures from $\frac{3}{4}$ to $1\frac{1}{2}$ inch in length and that of Pima and Sea Island from $1\frac{1}{2}$ to 2 inches. A fibre consists of a single hollow cell in the form of a long, narrow tube. As it ripens it loses its tube-like form, becomes flattened, and, after the boll opens, develops a peculiar twist. The presence of this twist imparts a roughness to the fibres which enables them to exert a certain amount of grip on each other, and makes it possible for them to be spun into thread. Immature fibres contain practically no twist, and they are very weak and brittle ; hence the presence of much unripe cotton reduces the value of the lint to an appreciable extent.

The seeds bearing the fibre or lint are known as seed-cotton, and the fibre after removal from the seeds constitutes the raw cotton of commerce. About one-third of seed-cotton is lint and two-thirds seed. Ginned Upland cotton seed consists of approximately 10 per cent. fuzz, 36 per cent. hulls, 20 per cent. oil, and 34 per cent. oil-cake.

The cotton plant is a perennial shrub, but under cultivation is generally considered to be an annual and is usually re-planted every season. Whether ratooning will be practised to some extent in the future is very unlikely.* By ratooning is meant the method of cutting off the old stalk close to the ground, when a new plant or "volunteer" takes its place the following year, re-seeding thus being eliminated. Authorities state that after the second year the lint deteriorates greatly by losing its gloss and strength—two of the most important and desirable properties of cotton.

The practice is not recommended, as the volunteer stand of cotton is usually insufficient to produce maximum yields, and the cost of interculture is out of proportion to the returns, besides favouring the increase of injurious insect-pests and the development of diseases. It is only under exceptional conditions obtaining in certain areas that ratooning might pay.

Climate.—Cotton is pre-eminently suited to warm regions. During the growing period the temperature should be uniformly hot, as the plant is very susceptible to sudden changes of temperature, and any check tends to produce premature ripening. Areas which in summer are subject to sudden changes of temperature or cold nights cannot be expected to produce good yields of first-class cotton. Continuous strong winds also have a detrimental

* See "Cotton : Ratooning Experiments," by J. du P. Oosthuizen, in the *Journal of the Department of Agriculture*, February, 1922.

effect on the crop. After the plants are full grown a lower temperature and dry weather are required in order to retard growth and further the development of the bolls. The plant being sensitive to frost, it is necessary that no frost occur for six or seven months, the time occupied in the growing and maturing of the crop. In localities that are subject to frost, planting should not be done before 1st October, but also not later than November.

A summer rainfall of not less than 18 to 20 inches, fairly well distributed over the whole period of growth, is essential. (This does not refer to areas where cotton can be grown under irrigation.) During the first five or six weeks the plant is delicate and weak, consequently the soil should not dry out too much during this time. Thereafter, the plant can withstand much drought, the taproot being long and penetrating well into the ground.

During harvesting time it is desirable that the weather be dry and sunny.

Soil.—The crop can be grown on nearly every type of soil where maize grows, provided it is deep and well drained. The most suitable soil, however, is a loam. A clay soil also gives good results, if it is well cultivated and the seed sown early. Light, sandy soil should be manured judiciously, otherwise the growth will be poor and a small crop reaped. Under favourable weather conditions "turf" soils occasionally yield excellent crops. It may be stated as a general rule that the most suitable soil is a deep, sandy loam or medium loam with good drainage, yet capable of retaining sufficient moisture to supply the demand of the crop. If the soil is very fertile, branches and leaves are formed at the expense of fruit.

Seed Selection.—The selection of seed plays a highly important role in cotton culture. It is essential that good seed be planted, and, as the cotton plant is very sensitive to climatic and soil conditions, the greatest care must be exercised in selecting seed-plants. The grower is advised to keep seed only of the most suitable plants for the following season's seed-plot. Seed should be taken from those plants which show uniformity of type and at the same time produce a great number of well-developed bolls. The height of a plant is not always an indication of its suitability. There are varieties of cotton which, under very favourable conditions, attain a height of from 8 to 10 feet; but those of about 3 to 4 feet usually give the best returns.

It is also important that the seed matures normally and is dried properly prior to being stored. If it is stored in a heap in a damp condition, overheating takes place and the power of germination is partly destroyed.

Varieties to Grow.—The industry has now reached a stage where it is possible to state with a fair degree of certainty which varieties are best adapted to the various areas of the Union. For the greater part of the Transvaal the so-called "Improved Bancroft" a large boll, long staple Upland variety, has proved one of the very best; it is therefore grown to the exclusion of practically all other varieties. In the Barberton District a little Watt's Long Staple and Zululand Hybrid are grown, but the bulk of the Barberton crop likewise consists of improved Bancroft. Another variety grown in the Transvaal is Uganda. In the Vryheid District, Natal, and in Zululand, Zululand Hybrid is largely grown; and in other parts of Natal, Griffin is a favourite. In the Transkei, Nyasaland Upland is the principal variety cultivated. Pima, an American-Egyptian variety, is now

being experimented with under irrigation in various parts of the country. Sea Island, and possibly a few other varieties, are grown on a small scale here and there, but those enumerated are the chief ones grown.

The cotton flower is most susceptible to hybridization by insects, especially bees, which fly for miles in search of food. It is therefore most important, if disastrous results and endless trouble are to be avoided, that farmers in one particular area or district should grow only one single suitable variety. Even if hybridization or crossing with other varieties is prevented there is the great danger of the seed of different varieties getting mixed at the ginneries, no matter how careful the managers may be. Unless multiplication of varieties is avoided our cotton cannot be expected to remain pure. Not that the varieties which are grown at present are by any means faultless, but they are rapidly being improved and purified, and have shown their suitability for the conditions of this country.

Soil Fertility and Rotation.—Most agricultural soils are deficient in one or more of the plant-foods, nitrogen, potash, and phosphorus.

If the growth is poor and the plants are yellowish, the soil is as a rule lacking in nitrogen. This plant-food can easily and economically be supplied to the soil by ploughing under as a green manure such leguminous crops as velvet beans, cowpeas, soya beans, and field peas. If nitrogen in commercial forms is to be used, it should not be applied too freely, as it tends to produce luxuriant vegetation and retards ripening.

A deficiency of potash can generally be detected by a large percentage of rusty leaves which drop off in great numbers, and by stunted growth and poor stalk development. Potash is present mainly in the stem and leaves.

Phosphorus appears to be the chief element required by practically all South African soils. The cotton plant is particularly sensitive to the absence of phosphates, a deficiency of which results in the production of a light crop of poor quality. The application of phosphatic manures checks coarse growth, tends to early ripening, and greatly improves the quality of the lint. On many South African cotton soils superphosphate can be used alone at the rate of from 400 to 600 lb. per morgen, depending on the soil and the previous treatment it has received;* but it is usually more effective if employed in conjunction with some nitrogen and potash or kraal manure. On sour soils an application of 1,000 lb. of agricultural lime will be beneficial. The practice of growing cotton year after year on the same land is not to be recommended, since it results in the gradual deterioration of both soil and crop, and the multiplication of insect pests and diseases. In planning a rotation it is well to include a leguminous crop; and as cotton has long, deeply penetrating roots it should be followed by a crop having a different rooting system, such as maize, kaffir corn, or buckwheat, more so as different crops remove the essential elements in varying proportions. The system to be adopted depends largely on circumstances and local conditions. It is useful to know that cotton is not subject to the attack of rooiblom (witchweed).

* If to be drilled in with a fertilizer attachment, half quantities are to be used.

Among the principal field crops grown commercially, cotton is the least exhausting. The following table, taken from "Cotton," by BURKETT and POE is interesting:—

Plant-Foods Drawn from the Soil by Crops.

Crop.	*Nitrogen.*	*Phosphates.*	*Potash.*	*Total.*
Cotton				
300 lb. of lint ...	1·02	0·30	1·37	2·69
650 lb. of seed ...	20·34	10·67	7·84	38·85
	21·36	10·97	9·21	41·54
Maize				
8¾ bags ...	32·14	12·36	7·06	51·56
4,000 lb. of stover ...	41·60	11·60	56·00	109·20
	73·74	23·96	63·06	160·76
Wheat				
3½ bags ...	19·75	7·44	5·10	32·29
2,300 lb. of straw ...	13·57	2·76	11·73	28·06
	33·32	10·20	16·83	60·35
*Tobacco**				
1,000 lb. of leaves ...	44·00	5·00	52·00	101·00
353 lb. of stalk ...	12·00	2·00	17·00	31·00
	56·00	7·00	69·00	132·00

The farmer should endeavour to obtain the greatest yields at a minimum cost by methodical and scientific treatment of the soil. This may be called intensive cultivation as contrasted with extensive cultivation. It is far better to grow 50 morgen of cotton yielding 1,600 lb. of seed cotton per morgen than to grow 100 morgen yielding 800 lb. per morgen.

Preparation of the Soil.—It is not possible in a concise article as the present one to state fully when and how the soil should be worked as so much depends on the class and type of soil and on the prevailing weather conditions. Where possible the lands should be ploughed in autumn or early winter, and to a depth of 9 to 12 inches—depending on the nature and kind of soil utilized. As soon as the first soaking spring rains set in the lands are ploughed again, if necessary, and rolled and harrowed to a fine tilth. As soon as all danger of frost has disappeared the seed can be planted. The earlier the planting the greater the chance for the plants to come to full maturity and the bigger the yield.

The seed germinates in from seven to twelve days. When the plant is about forty to fifty days old the first flower-buds (squares) appear; after that it takes some three weeks for the buds to open. From the time of the open flower until the boll opens is a period of another fifty days. The warmer the weather the sooner the bolls open.

* Taken from Killabrew and Myrick's "Tobacco Leaf."

When and How to Plant.—Seeding is done between October and the middle of November. In the warmest low veld areas planting may be done until the end of November. In fertile soil the distance between the rows should be approximately four feet but in poor soil not wider than 3 feet. In sticky or heavy soil the seed must be planted thicker than in sandy, light soil. As the young plants emerge from the ground similarly to bean plants, the depth of seeding should not be greater than from one to two inches, otherwise the cotyledons (seed-leaves) are unable to push through the hard-crust of earth which is formed after rain. Should the seedlings be unable to burst through this crust, as is often the case on some soils, a light harrow dragged across the rows will be helpful.

Forty to fifty lb. of seed are ample for planting one morgen of ground. When the plants have reached a height of six to eight inches they are thinned out to a distance of about ten to twelve inches apart. Thinning is done with hand-hoes, or if the soil is soft and moist, by hand.

Cultivation.—The object of cultivation is to destroy weeds which would damage and perhaps choke the crop; to break the crust formed by sunshine after rain, thus creating a mulch whereby capillary action is impeded and the moisture-holding capacity of the soil improved; and to facilitate the penetration of air into the soil. Proper cultivation also aids the growth of useful bacteria, the chemical solution of plant-food, and checks insect-pests.

As soon as the plants are well above the ground, cultivation should be proceeded with, and repeated after each rain as soon as the soil has dried sufficiently to prevent puddling. At first it may be deeper than afterwards, especially when a heavy rain has caused packing of the soil. But the plants have attained a height of ten to twelve inches the cultivator should not be set deeper than three inches. The feeding-roots of the cotton plant spread from three to nine inches under the surface of the ground; deep cultivation would consequently result in the breaking of the roots, and the plants would suffer. Cultivation should be continued until the bolls make their appearance. Shortly afterwards this operation should be discontinued, otherwise the squares may get bruised and the yield diminished accordingly.

Picking.—As soon as the cotton fields are white with open bolls, that is when about a third of the bolls are open, harvesting should be commenced. It takes approximately three pickings before the whole crop is gathered. When cotton is wet after rain or heavy dew, harvesting is not proceeded with until it is dry. If it is found that moist seed-cotton has been picked, it should be spread open on bucksails or canvas to dry, and then stored in a clean, dry, protected shed or on a loft.

Care should be taken to pick only seed-cotton—all leaves, pieces of boll, and other foreign matter are to be avoided and discarded, as such impurities detract from the value of the product. Soiled cotton should be gathered and ginned separately. The employment of native women and children for harvesting is the most economical. Picking is light, clean, and attractive work. An active woman can pick as much as 75 lb. per day if the plants are rather full of open bolls. The average, however, is 40 lb. of clean seed-cotton per day. Some natives who have become skilled in the work can pick as much as 100 lb. per day.

Muid sacks are commonly used in this country for harvesting. On both sides of the opening a riem of cord is fastened and then hung over the neck and shoulders of the picker. Picking is the most expensive item in cotton production.

Ginning and Preparation for Market.—The cotton is conveyed in wool packs to central establishments for ginning. This consists in separating the lint from the seed. About one-third of the weight of seed-cotton is lint and the remainder seed.

There are two kinds in general use, namely, roller-gins and saw-gins. The former is used for long-staple cottons with naked seeds, and the latter almost exclusively for ginning cottons with fuzzy seeds. The great majority of gins are saw-gins, as they do much quicker and cheaper work. An ordinary roller-gin requiring 2-horsepower can treat about 35 lb. of seed-cotton per hour, whereas a saw-gin with the same horsepower can gin 180 lb. per hour. The saws of the latter have a speed of some 400 revolutions per minute, and the teeth of the saws pull the lint from the seeds, while a brush, revolving at high speed, again removes the lint from the saws.

The following results, obtained at the Rustenburg Experiment Station, are interesting :—

COMPARISON BETWEEN ROLLER AND SAW GINS.

Type of Gin	Time	Variety of Cotton	Quantity of Seed Cotton Handled.
Roller-Gin (roller 3 ft. 3 in.)	1 hour	Pima	44½ lb.
Do ,, ,, ,,	1 ,,	Improved Bancroft	23 ,,
50-saw Gin ,, ,, ,,	1 ,,	Pima	525 ,,
Do ,, ,, ,,	1 ,,	Improved Bancroft	485 ,,

Before the invention of the saw-gin in 1792 by WHITNEY and HOLMES in America, it took one man a whole day to separate 1 lb. of lint with his fingers (the general practice followed at the time). After the machine had come into use the growing cotton in North America made enormous strides. The increasing demand for ginning in the Union of South Africa is being met, and to-day there are several large gins permanently established in various parts of the Transvaal and Natal.

After being ginned the lint is pressed by means of a powerful press into bales of 54 inches by 27 inches by 20 inches, and weighing approximately 500 lb. each. The bales are covered with hessian or sack cloth and fastened with iron hoops to prevent them from expanding. South African bales are, as a whole, far neater, more attractive, and less wasty than American bales.

Cost of Production and Profit.—Cost and profit naturally depend largely on the value of lint, the yield, and the distance from the ginneries. Even if these should be quite favourable, sufficient labour must be available at reasonable wages. Without an ample supply of cheap labour it is almost hopeless, if not impossible, to grow cotton profitably. Fortunately, most parts of the Union suitable for the growing of cotton are very well supplied with cheap labour.

The cost works out at about £4 to £6 per morgen, and the net pro at about £8 to £16. It is not possible to give definite figures as so much depends on the farmer himself, on circumstances, and on the many variable factors that enter into the estimate. This, however, may be stated with certainty, that, where conditions are favourable and the farmer does his duty, cotton is a profitable crop to grow and pays better than maize. Moreover, the cotton plant in South Africa is not yet subject to such serious insect-pests and diseases as it is in America and Egypt, where the profits of the growers are greatly reduced by the depredations of the cotton boll weevil and the pink bollworm respectively. When cotton is grown on a more extensive scale, more pests will most likely make their appearance ; but in such event means will no doubt be devised to combat them. Bollworms are at present the greatest pest the South African cotton grower has to contend with. Leaf-hoppers (jassids) also cause some loss in certain areas.

Cotton lint has the advantage that it be kept for many years without any danger of deterioration, and there is an ever-increasing demand for it.

Conclusion.—North America produces about 60 per cent. of the world's cotton. In most other countries where it is grown to any great extent the possibilities of a much greater production are either more or less small or certain limiting factors are present. The only countries where cotton can still be grown extensively are Africa and a few of the South American Republics, especially Brazil. Much is being done by European commercial bodies to further cotton growing in Africa, as it is a vital matter to the cotton factories, in which hundreds of millions of pounds sterling have been invested, and on which millions of people are dependent for their daily bread.

Every year the United States of America manufactures more of its cotton, and more textile buildings are being erected, with the result that the spinners in England and on the continent of Europe are unable to obtain full supplies for their own mills. Furthermore, the boll weevil is making such inroads in the American crop that, instead of the production increasing, it is at a standstill or actually decreasing. The demand is increasing much faster than the supply. Hundreds of millions of the world's population are still only partly clad, or practically naked. The different races are steadily adopting the garb of civilization. The production of wool and other fibre suitable for clothing is so limited that at present the only solution seems to be the very much greater production of cotton.

The tendency is for prices to remain high, and even to rise still higher ; this tendency will increase when conditions in Europe become more settled. The cotton grower therefore need have no fear whatever of over-production. In 1764 North America exported eight bags of cotton to Liverpool, and this probably represented the whole amount exported during that year, whereas to-day the export runs into several millions of bales. The amount of cotton produced in South Africa at present may not be very large, yet it is most encouraging if one considers that the culture of this crop is of recent date and practically unknown to many farmers of this country. Furthermore, the vast northern and eastern sections of the Union, where cotton is being grown most successfully, are still sparsely populated by Europeans. The prospects of the cotton grower are decidedly good, and there is not the slightest reason why thousands of farmers in the middle and low veld should not give attention to this most promising and remunerative crop.—Journ. of Dept. of Agric., U.S. Africa, Vol. XIII, No. 1.

PADDY.

VARIETIES OF CEYLON PADDY.

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Ceylon is reputed to possess over five hundred varieties of paddy. The late Nugawela Disava exhibited at the Kandy Agri-Horticultural and Industrial Exhibition held in 1902 a collection of 300 named varieties collected throughout the Island. About ten years back I took possession of his list and part of the paddy from Mr. Jas. R. Nugawela, Agricultural Instructor, and both of us tried to replace the lost varieties but without success. At that time most of the samples of paddy had gone bad. In 1915 and 1916, from the Office of the Ceylon Agricultural Society, I attempted to obtain the names of paddies grown in the different districts from various headmen and through the Agricultural Instructors, then few in number, and I was able to make up a list of only 168 names. When a collection of paddies now growing throughout the Colony was being got together to be sent to the British Empire Exhibition we found that not more than 150 kinds were available and even among these we found the same paddy sent from different districts with a slightly altered name. It must therefore be presumed that only about one hundred and fifty types are now being grown throughout the Island.

The following list of the names of paddies has been compiled from the late Nugawela Disava's list and from information I have gathered from various sources during the last ten or twelve years. I do not believe that so many different kinds of paddies ever existed in Ceylon. It is clear that no system has been followed in naming paddies. The cultivator gives a name, sometimes an appropriate name, whenever a supply of new seed is obtained and when that paddy gets distributed it carries its new name with it. For instance, the paddies the Economic Botanist has given out in recent years, owing to their not being named, are known in the villages as Peradeniya Mavi or Peradeniya Samba. The paddy raised from Hatiel and Hondaravala, selected by me, is known among cultivators as Molegode Hatiel and Molegode Honderavala. The paddy the late Dr. Lock tried and distributed is known as Lock's paddy. Ajantawi is a paddy that a Government Agent introduced to the district. Matale-heenati is heenati from Matale now growing in Ulagalle Korale; Madakalapu balawi is short-aged paddy from Batticaloa now growing in Wellessa and in this manner the names of Ceylon paddies have got multiplied. Then again, the main types are sub-divided into Kalu (black), Sudu (white), Ratu (red), Kiri (milky), Bala (short-aged) and so on as for example Kalu-heenati, Sudu-heenati, Kirikottiyaran, Bala-kottiyaran, etc.

In the following list are also included the names of paddies introduced to the Colony in recent years; but most of them have got so mixed up that it is unlikely that the paddies, except a few varieties like Molagusamba, Rascadum, or Gawrisamba, can be recognised.

The figures within brackets indicate the "age" of the paddies by month. It should, however, be remembered that the age (time of maturity) also differs when varieties are introduced from cold to hot districts and *vice versa*, and types of paddies like Kuruwi, Kohuwi, etc., are three months in some districts but 4 and 5 in some. Mawi is 8, 7, 6 and even 5 months.

1 Ahas-kara-elwi (5-6)
2 Ahunel wi (4-5)
3 Ajanta wi (4)
4 Alagusamba (5)
5 Alakiyaranam
6 Amala Waria Samba (5)
7 Amba kuruwi (5)
8 Ambala elwi (4½)
9 Andu kara-elwi (5-6)
10 Anai kodan (5)
11 Anai Kothan Samba
12 Anchu Moligan Kaduppen
13 Andun Kottan
14 Aruvathan Vellai Samba (4)
15 Askarayal (4)
16 Atharali Samba (4)
17 Ava Sura Samba (115 days)
18 Badshabog (6)
19 Balada el (5)
20 Bala dikwi (4)
21 Bala elwi
22 Bala goda wi (3)
23 Bala hatiel (5)
24 Bala heenwi (4)
25 Bala kalu wi (4)
26 Bala-kalubawi (3)
27 Bala kiri kottiyaran (3)
28 Bala kohumawi (5)
29 Bala-kottiyaran (3)
30 Bala-kuruwi (4)
31 Bala-madata valu (3)
32 Bala mada wi (4-5)
33 Bala-mawi (6)
34 Bala-mukala wi (4)
35 Bala-panneti (3)
36 Bala-rata-wi (4)
37 Bala-ratu wi (4)
38 Bala sudu karayal (4)
39 Bala sudu wi (4)
40 Bala sudu kuruwi (4)
41 Bala-thatu wi (4)
42 Bala-tudu wi (4-5)
43 Bala wi (2½-3)
44 Bankok
45 Banku (4)
46 Bathbowi (6)
47 Bathjan kaharamana (4-5)
48 Batu el (4)
49 Batu kiriyal (4)
50 Batu kuruwi (4½)
51 Bibili el (4)
52 Bopatwi (5)
53 Boraluwi (5)
54 Boro (6)
55 Buruma wi (5)
56 Carolina (5)
57 Chenadi (3)
58 Chithirai kali (4)
59 Chittra elwi (5)
60 Chori kurumbai
61 Colomba wi (6)
62 Daha elwi (4½)
63 Dampotu wi (4)
64 Dandu el (4)
65 Dandu-mara-wi (5)
66 Dasyawakara wi (4)
67 Demarara (4 varieties) (6)
68 Dena-kahanaran (5)
69 Dena kara el (5)
70 Dena wi (5)
71 Dena-pola-elwi (4-5)
72 Denuwara wi (5)
73 Dewareddiri
74 Dhanala (4)
75 Dik heenati
76 Dik-suduwi (5)
77 Dik-taluwi (5)
78 Dik-tuduwi (5)
79 Dik wi (5)
80 Dodki (6)

81 Dotulu-wi (5)
82 Ehetu wi (5)
83 Ekavai
84 Ekel Samba (5)
85 Ekku Samba
86 Elan balyan (5)
87 Elan-kolyan (5)
88 Ele-handiram (5)
89 Ella nellai (4)
90 El-pola-el (5)
91 Ele-wena wi (3)
92 El-wi (4-7)
93 Endi-elwi (4-5)
94 Fino (5)
95 Gal honderavala (5)
96 Galkada (4)
97 Galkada Elwi (4-5)
98 Gal pawi (3½-4)
99 Gamboda heeneti (4)
100 Gana-tumba-elwi (4½)
101 Gana tumba-wi (5)
102 Gangala wi (5)
103 Gawri Samba (5½)
104 Getala-valu (3½)
105 Gini kurumba wi (4)
106 Gira-el (4-5)
107 Girange-mana wi (5)
108 Giressa (4-5)
109 Gnavara (2½)
110 Goda-handiram (4-5)
111 Goda-hondaravalu (4½)
112 Goda mawi (4½)
113 Goda-tavalu (4)
114 Goda wi (3-4)
115 Golden-seal paddy (6)
116 Guru hatelli
117 Guru wi (5)
118 Hâl-bo wi (6)
119 Hâl-sudu wi (45)
120 Hâlwedi wi (5)
121 Hamba wi (5)
122 Handiram (5 6)
123 Hane-el (5)
124 Han-kara wi
125 Hat-el (6)
126 Hatheli (5)
127 Hath-kiriyal (7)
128 Hatiel (6)
129 Hapumal wi (5)
130 Heen askarayal (4)
131 Heen boraluwi (4)
132 Heen-dena karamana (5)
133 Heen deva karayel (6)
134 Heen deweredderi (6)
135 Heen dikwi (4-5)
136 Heen el (5)
137 Heeneti
138 Heen hamba (5)
139 Heen-kahanâran (5)
140 Heen kalu dhanala (5)
141 Heen kalu el (4)
142 Heen-kaluwi (4)
143 Heen kara el (5)
144 Heen karalina (5)
145 Heen karulu wi (4-5)
146 Heen kirinâran
147 Heen kohuma wi (6)
148 Heen-kurumba wi (4-5)
149 Heen-kuruwi (4)
150 Heen mudukiri-el (4)
151 Heen mukalawi (5)
152 Heen naduwi (4)
153 Heen panneti (4-5)
154 Heen pinala el (5)
155 Heen-pola el
156 Heen-puluk-hamba (5)
157 Heen-ratawi (4-5)
158 Heen-rath-el (5)
159 Heen-ratuwi (4-5)
160 Heen-sapumal wi (5)
161 Heen sivuru wi (4)
162 Heen-sudu hatel (6)
163 Heen-suduwi (4)
164 Heen suvande el (5)
165 Heen-tavala (4)
166 Heen tudu wi (6)
167 Hetada-wi (2-2½)
168 Hondaravala (5)
169 Huru thaluwel (6)
170 Ilan kalayan (4)
171 Illankalai (5)
172 Inasimang (169 days)
173 Indian kuru wi (2½)
174 Indrasal (5)
175 Induru-karayal (5)
176 Irumbuwi (5)
177 Irungavânan (4)
178 Japan wi (2½)

179 Jeera Samba (3½-4)
180 Kachchipota (3½)
181 Kadai kalluthan
182 Kaha el (7)
183 Kaha kottambe (6)
184 Kaha naran (5)
185 Kaha podi el (5)
186 Kaha sivuruwi (5)
187 Kahata el (6)
188 Kahata-hamba (4-5)
189 Kahatanel (7)
190 Kahata wi (5)
191 Kaha thatu el (5)
192 Kaha tuduwi (4)
193 Kaiwara samba (5)
194 Kalabawi (4)
195 Kalamba (6)
196 Kalanpei (5)
197 Kal kooran
198 Kalkunda (5)
199 Kalu akuramboda (3½)
200 Kalu balawi (4)
201 Kalu boraluwi (5)
202 Kalu dena karayal (5)
203 Kalu el (5)
204 Kalu giressa (5)
205 Kalu goda-heeneti (4)
206 Kalu hamba heenati (6)
207 Kalu handiran (6)
208 Kalu hathiel (6)
209 Kalu heenati (4-4½)
210 Kalu heendik wi (4)
211 Kalu hondarawala (3)
212 Kalu kahata samba (5)
213 Kama kambu samba
214 Kalu-kanda wi (4)
215 Kalu karawi (6)
216 Kalu-kiri-handiram (6)
217 Kalu kochi (5)
218 Kalu kohumawi (7)
219 Kalu kombila
220 Kalu kumara (5)
221 Kalu kumara mawi (7)
222 Kalu kumara samba (5)
223 Kalu kurumba wi (5)
224 Kalu kuruwi (5-6)
225 Kalu wi (4-6)
226 Kalu madaluva (5-6)
227 Kalu mukala wi (6)
228 Kalu nadu madaluwa (5-6)
229 Kalu nahatu wi (6)
230 Kalu nara kuruwi (3½)
231 Kalu wiyan kaliyan (4)
232 Kambiwi (5)
233 Kandu kara wi (5-6)
234 Kandupahala balawi (2½)
235 Kandy murunkan
236 Kara (4)
237 Karalkalu wi (5)
238 Karalnemu wi (6)
239 Kara samba (3)
240 Karuppen (5)
241 Karutha Illankalayan
242 Karutha perinellu
243 Kekkiri kotta samba (4)
244 Kerali
245 Ker karuppen (3)
246 Kerundu samba
247 Kewatta samba (5)
248 Kiri-el (4½-5)
249 Kiri-ela handiram (4-5)
250 Kiri kara (3)
251 Kiri kottiyaran (5)
252 Kiri kunda (3)
253 Kiri kurumba (5)
254 Kiri naran (5)
255 Kiri rat-el (5)
256 Kiri-sudu-el (7)
257 Kitul pathwel (6)
258 Kochchi wi (4)
259 Kohu balawi (4)
260 Kohu honderavala (5)
261 Kohu kararamana wi (5)
262 Kohu maladuwa (6)
263 Kohu mawi (7)
264 Kohu mudukiriel (5)
265 Kohu rat-el
266 Kohu wi (5-7)
267 Kokku vellai
268 Kola bara wi (4)
269 Kola el (3-4)
270 Kolol (3½)
271 Koranki
272 Koseta-el (4)
273 Kota handiram (5)
274 Kottamalli (5)
275 Kottamba wi (5)
276 Kottiyaran (4-5)

277 Kulla salai
278 Kunchinelli (4)
279 Kuru bala hamba (4)
280 Kuru bala wi (3-4)
281 Kuru mawi (7)
282 Kuru nara wi (5)
283 Kuru rata wi (5)
284 Kuru ratu wi (5)
285 Kuru sudu wi (5)
286 Kuruvai (2½)
287 Kuruvinelli (4)
288 Kuru wi (5)
289 Kurulu tudu wi (5)
290 Kurulu wi (5-6)
291 Lemasooria wi (5)
292 Lena-el (4-5)
293 Lock's Hathiel (6)
294 Loku giressa (5)
295 Luan Ton (5)
296 Luan tuang (5)
297 Macan (179 days)
298 Macan Pina (143)
299 Mada-el (6)
300 Madakalapu bala wi (3)
301 Madapola el (6)
302 Madatavalu (6)
303 Mada wi (4-6)
304 Madol (3)
305 Maddai karuppen (5)
306 Maha bam kottel (5)
307 Maha bibili-el (4-5)
308 Maha-boralu el (5-6)
309 Maha dandu-elwi (7)
310 Maha dikwi (6)
311 Maha hatiel (7)
312 Maha honderavala (6)
313 Maha kahanâran (5)
314 Maha kalumadaluwa (5)
315 Maha kaluwi (6)
316 Maha karanâran (4-5)
317 Maha karayal (7)
318 Maha kirinâran (5)
319 Maha kottamba (6)
320 Maha mada-el (4-5)
321 Maha madaluwa (6)
322 Maha madol (4)
323 Maha mahawi (8)
324 Maha mukalawi (7)
325 Maha mut-tès (7)
326 Maha nandu (6)
327 Maha nandu madaluwa (7)
328 Maha-pinna-el (4-5)
329 Maha rath-el (5-6)
330 Maha rathkunda (7)
331 Maha ratuwi (6)
332 Maha-sudu kochchi (5)
333 Maha sudu madaluwa (6)
334 Maha suduwi (6)
335 Maha wekala-el (4-6)
336 Maha-wi (7-9)
337 Malayalakan Vellai
338 Malvaran (3)
339 Mana medera samba (5)
340 Manalvari (5)
341 Mana samba (4)
342 Manchel Karuppen (4)
343 Manel wi (6)
344 Mangal saral
345 Marawi (4)
346 Matale heeneti (3)
347 Meepath-elwi (6)
348 Milchai (5)
349 Molagoda hatiel (6)
350 Molagu samba (5)
351 Moli karuppen (4)
352 Mookala dahanala (5)
353 Moopengun (4-5)
354 Mothai karuppen (4-5)
355 Mothai kiriyai
356 Mothera gam perunel (6)
357 Mookala wi (6)
358 Mudu kiriel (4-5)
359 Mullu kallunda (5)
360 Mullai nellu
361 Mulanay (4½)
362 Murungan (4½)
363 Murunga wi (5)
364 Mutu kallunda (4 & 5)
365 Mutu manikkan (5 & 6)
366 Mutu rundai
367 Mutu samba (5-6)
368 Nadu kalu rata wi (5)
369 Nadu magalpawi (5)
370 Nadu maha bala wi (4)
371 Nadu maha kirinâran
372 Nadu maha kuruwi
373 Nadu maha ratawi (6)
374 Nadu mawi (7)

375 Nadu mookala wi (5)
376 Nadu murunken
377 Nadu wi (6)
378 Nalawariya
379 Narakuru wi (3½)
380 Norungan (4)
381 Onnari Valan
382 Oran samba
383 Ottavalan
384 Pallai sittarai (4)
385 Panan kalayan (4)
386 Pandinelli
387 Pannán kalayan samba
388 Panni (144 days)
389 Panniti (4)
390 Patcha Perunel
391 Penitivi (4)
392 Peradeniya wi (5-7)
393 Perennial paddy
394 Peria illunkulai (6)
395 Peria murungan
396 Perinel (5)
397 Peria nelli (6)
398 Periya samba (5)
399 Periya vellai
400 Perunel samba (6)
401 Pihatu elwi (4)
402 Pihatu wi (4)
403 Piniling deni-el (171 days)
404 Podi heeneti (4)
405 Podi kalu heenati (4)
406 Podi kirinaran (3)
407 Podi madaluwa (5-6)
408 Podi mavi (7)
409 Podi mut-tès (5)
410 Podi rata wi (4)
411 Podi sayan (3)
412 Podi soolai (5)
413 Podi sudu dahanala (4-5)
414 Podi sulu wi (5)
415 Podi wi (4-5)
416 Pokuru meepat-el
417 Pola el (4-5)
418 Ponati (4)
419 Postuguer
420 Potu wi (4)
241 Puluk hamba (5)
422 Punchi bibile-el (4½)
423 Punchi pinna-el (4½)
424 Puru palai
425 Pura samba
426 Pusbaraha wi (4-5)
427 Puvilan kalayan
428 Puwak malhatili
429 Puwak malwi (5)
430 Raman samba (6)
431 Ran halwi (5)
432 Ran karayal (5)
433 Ran kuruwi (5)
434 Ran manikkam (3)
435 Ran pothwi (5)
436 Ran wi (5)
437 Rascadum (3½-4)
438 Rata karayal (5)
439 Ratalavalu (4)
440 Rata mawi (6-7)
441 Rata samba (6)
442 Rata suduwi (5)
443 Rata wi (4-7)
444 Rathdel (4)
445 Rath-el (6-7)
446 Rath-kunda (4)
447 Rathu giressa (5)
448 Rathu handiram (5)
449 Rathu hatiel (6)
450 Rathu honderavalu
451 Rathu mapath-el
452 Rathu pat-el (7)
453 Rath-wel (4)
454 Sadai samba (6)
455 Saigun (4)
456 Samba (5-7)
457 Samba-vellai-samba
458 Samuddrabala wi (5)
459 Sapu dewaredderi (6)
460 Sapumalwi (6)
461 Sarali
462 Sathara korale elwi (6)
463 Savakar
464 Sebeneri (5)
465 Seenadi (4)
*466 Seigun (4)
467 Sellai kai
468 Senegal (5)

469 Senors II (145) days
470 Shangale (3)
471 Sheeraka samba (4-5)
472 Sinna karuppen (4)
473 Sinna madel (4)
474 Sinna mutu samba
475 Sinna samba (4½)
476 Sinna vellai
477 Sinna vellai samba (4-5)
478 Sirumanian samba
479 Siruvellai (4)
480 Sith-therai keli (4)
481 Sivuru wi (5)
482 Sudu akuramboda (3)
483 Sudu dahanala (4-5)
484 Sudu deni karayel (5)
485 Sudu dewaredderi (6)
486 Sudu-duru wi (5)
487 Sudu giressa (5)
488 Sudu handiram (6)
489 Sudu hathiel (6)
490 Sudu heenati (4)
491 Sudu honderavala
492 Sudu inalni
493 Sudu kahata hamba (5)
494 Sudu kanda wi (5)
495 Sudu kara-el (5)
496 Sudu kara wi (5)
497 Sudu kiri wi (5)
498 Sudu kochchi (5)
499 Sudu kohu mawi (7)
500 Sudu kottiyaran (5)
501 Sudu kurumawi (5)
502 Sudu madaluwa (5)
503 Sudu malwi (5)
504 Sudu mawi (7)
505 Sudu meepat el (6)
506 Sudu mookalawi (5)
507 Sudu murungawi
508 Sudu nadu madaluwa (5½)
509 Sudu rata wi (5)
510 Sudu thatuwi (5)
511 Sudu wi (5)
512 Sulai
513 Sultani (5)
514 Surumuni-el
515 Suvanda wi (5)
516 Suvande-el (5)
517 Taka suka (6)
518 Tala-mal-el (4-5)
519 Tana samba
520 Tanayel-el (5)
521 Tanjore samba (5)
522 Taung-deik-Pan (6)
523 Tawalu-heeneti
524 Thanga pullai heeneti
525 Thattan samba (4)
526 Thatuwel (6)
527 Thati wi (5)
528 Thilla nagakan (4)
529 Thonnur (3)
530 Thunmaswi (3)
531 Tillanaayagam
532 Tirakanthana
533 Tiranayagam samba (5)
534 Tsimakata (9)
535 Tudu wi
536 Tuttiri-el (4-5)
537 Udarata samba (6)
538 Ukpuruk-wi
539 Upland paddy (5)
540 Uran samba (4)
541 Uruwi (6)
542 Vadam samba (4)
543 Vanan (3)
544 Varian (2½)
545 Vattu keriyai
546 Vattu kottai
547 Vattu pittan
548 Vayaga samba
549 Vayal valai
550 Vellai garadu samba
551 Vellai kurunellai (4)
552 Vellai perin-el (5)
553 Vellai samba (5)
554 Vellai samba
555 Vellai vanan (4)
556 Vellai vethumyla (3)
557 Viran vainan karuppen
558 Vokola-el (4½)
559 Vyaka samba (4)
560 Yahaing (3)
561 Yapani (5)
562 Walkanati (6)
563 Wanni heenati (2½-3)
564 Wanni wi (3)
565 Wari kayan (3½)
566 Wedirata wi (2)
567 Wellessa wi (3)

LIVE STOCK.

THE SCOPE FOR DAIRY FARMING IN CEYLON.*

SIR H. MARCUS FERNANDO, M D.

That dairy farming and animal husbandry constitute an important and indispensable branch of agriculture no one can dispute, but hitherto little or no advance has been made in this department in Ceylon. Milk and butter are essential food products, and the former is indispensable in infant feeding. It is therefore of the utmost importance for any country or people to have a ready supply of dairy products of sound quality at a reasonable cost. Year after year we hear of the appalling death-rate amongst infants in our urban centres, and on the estates and plantations. This great waste of human life is partly due to the inability of the poorer classes to obtain fresh milk at a moderate price. The price of milk in Colombo is inordinately high, utterly beyond the reach of the lower classes. In some parts milk is not obtainable at any cost.

How much this country depends on its imports for dairy products may be gauged by the customs returns :— We imported in 1923—

		lb.	Value Rs.
Butter, frozen and tinned	...	533,674	583,424
Milk, preserved and tinned	...	1,087,725	493,410
	Total		1,076,834

This dependence on foreign countries is due principally to the fact that no attempt has hitherto been made to breed dairy cattle in a systematic manner on a scale adequate to supply the country's requirements. We have depended to a great extent on the cows imported from India, a country whose best dairy breeds are far inferior to European standards. With poor milking cows the cost of milk production is necessarily high, and when in addition to this handicap rinderpest and other Epizootics are endemically present in and around Colombo, little explanation is needed to account for the extraordinarily high price that fresh milk commands.

The question then arises whether there is scope in Ceylon for the breeding of high class milch cows, and to what extent the possibilities for successful dairy farming exist in the present state of agricultural practice. Tea and rubber estates offer very little scope for cattle breeding ; yet despite many difficulties small herds of European cattle are scattered throughout the hill plantations, maintained almost entirely on stall feeding. Pasturage for grazing, and ground for exercise are not available on such plantations ; and even where land is available it is too valuable to be laid down for pasturage.

On coconut plantations the conditions are entirely different. There is always some pasturage between the palm trees as the land is not clean weeded. Over the moist zone of the coconut area, say in the Colombo, Negombo, and part of the Kurunegala District, the pasturage available in the low-lying sections of coconut plantations is considerable, and is capable

* Paper read before the Board of Agriculture, held on March 13, 1924.

of carrying a fair number of cattle. Such pasturage can be further increased and improved by cultivation and manuring. Moreover, coconut estates generally include low-lying areas here and there which may be laid down permanently under grass for stall feeding. Such reserves enable an estate to feed the cattle during a long drought, when open pasturage is dried up. As a matter of fact most coconut plantations carry cattle, but the fault is that they carry more cattle that the pasturage is able to feed. The proprietors generally take little or no interest in breeding livestock. They leave the matter entirely in the hands of their managers who have no knowledge of cattle breeding. The stock explanation for the unhealthy condition of cattle under such circumstances, is that the cattle are meant for manure and for no other purpose. The belief is general that the amount of manure obtainable from a given area depends on the number of cattle one can place on it. The fact is overlooked that the amount of manure is determined by the quantity and quality of the pasturage and not by the number of cattle that graze, and that the policy of overstocking on coconut estates is both mistaken and profitless.

It is more profitable to breed say twenty head of useful selected cattle on a hundred-acre estate rather than permitting a poor stunted half-starved herd of forty to roam about the plantation, a prey to disease and a source of danger to neighbouring herds. In this again the owners of estates are seriously handicapped. Managers of estates who understand the principles and practice of stock breeding on modern scientific lines are not available locally.

I hope that with the opening of the dairy at Peradeniya this year, the diploma-holders of the Agricultural College there will be qualified to carry out such work. Despite all these drawbacks and difficulties it is an agreeable fact to find that several proprietors owning coconut plantations have succeeded in breeding very useful and improved type of cattle on their lands. In the low-country such success has been restricted to the breeding of Indian types which, however, as I have already pointed, are not satisfactory dairy animals.

Even some of the best type of Indian milch cows, such as the Scind, do not yield anything comparable to the milk breeds of Europe. The Government of India have fully realized this, and have therefore undertaken to set up dairy farms and breeding stations for the special purpose of improving the milk strain of Indian cattle. It is not possible to assert with any degree of accuracy the milk yield of Indian cows in Ceylon, as milk records of dairy herds are not kept as in England or elsewhere. As a rough approximation the average yield of such cows, in a milk herd, may be stated at 200 to 300 gallons per annum. Such a cow would be considered very unprofitable in England, as it would not pay for its maintenance in a herd. The Board of Agriculture in England with the object of weeding out unprofitable animals from milking herds, restricts its subsidy only to cows giving over 600 gallons a year, and there are many herds throughout the country which can boast of a record of over 1,000 gallons per cow per annum. Last year the milk recording scheme of the Board of Agriculture disclosed the fact that there were in England some 114 cows giving an annual yield of over 2,000 gallons. These yields, enormous in comparison to the output of Indian cattle, is the chief factor in lowering the cost of milk production.

In dealing with our milk problem our first consideration must therefore be diverted to the improvement of the milk yield of our cows. No permanent advantage can be gained unless this fundamental defect is righted. What then are the means whereby we can attain this end? Two separate methods of selective breeding can be utilized. We can start with one of

the best Indian types and proceed to select and breed from the best milkers within that type—a long and laborious process which may require perhaps thirty or forty years of continuous work to attain tangible results. The second method is to mate cows of Indian or other breeds to a pedigree stud bull of known milk strain, and continue this process of always using a pure strain bull for three or four generations. This is a quicker and surer process, a grade of animals approximating to the type of the sires may be obtained with practical certainty in three or four generations, say in ten or twelve years.

Both these lines of selective breeding are practised in the Government breeding and dairy farms in India, and some noteworthy results have already been obtained. At Pusa both lines of selection are pursued side by side. Pure Montgomery cattle are bred as well as cross-bred animals between Montgomery cows and Ayrshire pedigree bulls. At some of the military dairy farms, Ayrshire cross-bred cattle are the predominant feature. More recently I learn that at Mysore an extensive experiment has been started by the Maharajah to cross native cows with Frisian bulls, under the direction of a Canadian cattle expert.

Similar work has been started in Ceylon, recently, and I hope that the enterprising planters concerned in such work will be good enough to report their results from time to time for the benefit of those who are waiting for such information to follow their example.

During the last three years my son, Mr. R. M. Fernando, has been conducting an experiment in cross breeding of this nature, with an imported British Frisian bull from England in the Kurunegala District on Meegahatenne and Aspokuna estates. Another such young bull was imported in December last to continue the experiment. I may here mention that Mr. Bowie of Talawakele, who has been a very successful breeder of European cattle for many years, imported in 1921 three British Frisians, one bull and two heifers. Results from these experiments have so far been satisfactory. Cattle imported from England or Australia require great care in the low-country, but cross-bred animals born in the low-country thrive readily if in addition to pasturage the animals are kept free from ticks.

Apart from the scanty pasturage that exists on coconut lands grass may be laid down for stall feeding in low-lying fields or on high land specially devoted for grass alone where suitable. I admit that the temptation to devote land for grass, otherwise suitable for growing coconuts, will never be great as long as land for coconuts or other permanent crops remain as high as they are at present. But to indicate how land devoted to grass growing compares with land given over to such uses elsewhere, I may submit the following figures from my own experience and observation. In the Colombo District and in the wet zone generally ten cuttings of Guinea grass can be obtained a year, yielding from 30 to 40 tons per acre of green fodder, when the land is properly and systematically manured. This grass is well suited to all sorts of livestock, and it is esteemed highly in India, and in other tropical countries where it can be grown. A similar yield can be obtained from water grass which however is not so nourishing, and which requires more moisture for its growth. A more concrete idea of these figures may perhaps be obtained when I say that each acre of such land can maintain three cows. This is in striking contrast of the three acres which is generally agreed upon as needful for the maintenance of one cow in England. We in Ceylon therefore have a decided advantage in the growing of fodder grasses.

I have so far refrained from alluding to the difficulties encountered in cattle breeding in Ceylon. I would be giving a very wrong view of the situation, were I to ignore this aspect of the question. The most important

obstacle to the successful breeding of cattle is undoubtedly the recurring epidemics of rinderpest and hoof-and-mouth disease. The former disease is the more deadly foe, as if it is allowed to spread it can decimate herds over a wide extent of the country. On the other hand, hoof-and-mouth disease is comparatively mild in the low-country, as the death-rate is small and recovery rapid. Nevertheless, it is disastrous to dairies as the milk yield is seriously affected.

Apart from these ravages cattle in Ceylon are not affected to the same extent to tuberculosis, pneumonia, and anthrax, as they are in Europe. The trouble with ticks is a factor that has to be fought incessantly on estates. The systematic use of the dip or spraying with arsenic solution is well worth while. Such protection has to be maintained year after year on low-country estates as the ground can never be freed from tick infestation, owing to their spread from wild animals such as hare and deer.

Sufficient evidence has already been advanced in this paper to show that there is ample scope in this country, to breed an improved type of milch cattle by appropriate selective methods. Once such an improved type of cows is available locally, the production of milk will not only be easier but will be much less costly. Efforts by private owners to carry out such work should receive encouragement in the form of land on easy terms, provided that such lands are devoted entirely for the maintenance of cattle and the growing of fodder crops. There is a great difficulty at present in obtaining lands, well watered, at a reasonable cost, as such lands are more valuable for permanent crops. Lands in the dry zone are not suited to the breeding of cows for dairy purposes. They may be satisfactory for the breeding of transport animals of the Indian type, and of buffalos, but not for the type of animals that will accelerate milk production.

INFLUENCE ON COWS' MILK SECRETION DUE TO THE CHANGE FROM DRY TO GREEN DIET.

E. GOLDONI.

The author has made an experimental study of the alterations in milk secretion and on the composition of milk in cows when sent to pasture after being fed on hay. The conclusions are as follows: grass feeding appears to favour an increased yield, especially at the evening milking, but it does not seem to affect the yield in proportion to the age of the cow, or the condition of the secretion. When on grass diet, the evening milking tends to be more abundant than the morning milking; the acidity of the milk of cows whose lactation period is already advanced increases whereas it diminishes with other cows and the point of congelation is slightly lowered; moreover, the density of the whey may diminish and its congelation point decrease. Grass feeding has no effect on the content in fatty matter and the examination of the average yields of all the cows shewed that for both dry and grass diet, the degree of acidity, the amount of dry and non-fatty residue, the density and the percentage of water were the same, although during the change of diet, the density had slightly increased for the morning milk and slightly decreased for the evening milk. On the whole, the variations between the figures for these different points were less marked for a grass than for a dry diet.—INTERNATIONAL REVIEW OF SCI. AND PRAC. OF AGRIC., VOL. 1., No. 3.

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DEPARTMENT OF AGRICULTURE, 1923.

EXPERIMENTS AND INVESTIGATIONS.

The following are the reports furnished by the Department of Agriculture for the 70th Annual Report of the Planters' Association of Ceylon :—

ESTATE PRODUCTS.

The experimental work with tea, rubber, cacao and coffee have been continued at Peradeniya Experiment Station and with limes, sisal and oil palms at Anuradhapura, with cotton at Ambalantota and with coconuts at Chilaw.

Special attention has been given during the year to the question of soil erosion and the introduction of several new leguminous cover plants made. There is no doubt that this question of soil erosion deserves the most serious attention by all interested in the agricultural welfare of Ceylon and that every possible step should be adopted towards preventing further loss of the finer and more fertile portions of our soils.

The experiments in connection with the control of shot-hole-borer of tea have been brought to a conclusion on Sarnia Estate and a fresh series has been commenced on New Peradeniya. The results of experiments indicate that good cultivation and liberal manuring are the most practicable means of controlling the spread of this pest. Tea termites have received considerable attention during the year and there appears to be reason to suppose that these pests are now the most serious pests affecting the tea crop. The chief disease of tea which attracted attention was the Witches Broom disease, This is at present under investigation.

Considerable difficulty has been experienced by the tea industry in securing supplies of tea seed. The Island's crop was very short during the year and in many cases germination was poor. The question of withdrawing the prohibition against the import of tea seed from India was discussed by the Estate Products Committee of the Board of Agriculture but it was decided that such a course could not be recommended, as the risk of introducing the leaf blister blight from India was too great.

Gliricidia maculata continued to give excellent results on the Experiment Station, Peradeniya, as a green manure and the demand for cuttings exceeded the supply.

The analyses of the yields of individual trees obtained from the tapping of rubber trees grown on the Experiment Station, Peradeniya, from the well-known No. 2 tree of the original Henaratgoda plantation have been continued. The latest figures available lead to the conclusion that yield is an inherent character independent of vegetative vigour and that no special cultivation or treatment can convert a poor yielder into a good one. This is a fact of considerable importance and may lead to some modification of the views previously held in regard to the manuring of rubber. Full details

of the results as analysed by MESSRS. BRYCE and GADD are to be found in Bulletin No. 68. Work on Brown bast has been carried out by officers of the Rubber Research Scheme and a census has been made on certain estates by the Physiological Botanist of that Scheme and MR. REEVE, Plant Pest and Disease Inspector, Southern. These investigations showed that the incidence of Brown bast is influenced very considerably by environmental conditions.

The yields of coffee varieties on the Experiment Station, Peradeniya, have been considerably higher during the year—probably the result of a liberal manuring. Sisal was prepared at Anuradhapura Experiment Station during the first half year and a good product has been prepared, and the lime and oil-palm areas considerably improved by systematic cultivation and attention.

The caterpillar pest of coconuts continues to do serious damage in the Batticaloa district of the Eastern Province, and has also been recorded from several new localities in the Central, North-Western and Western Provinces. The Department recommends that all growers should keep this pest under close supervision and that it should not be allowed to become a serious pest in several localities. An outbreak of black beetle occurred in the Matara district and has been brought under control in certain sections of the affected area by means of a vigorous campaign.

The Cotton experiments at Ambalantota have been encouraging and good yields have been again secured. Over 500 acres have been planted in cotton in the Hambantota district this year and smaller areas are being grown in the Matale district of the Central Province, the Province of Uva and in the North-Western Province.

A special Committee considered during the year the equipment of the Experiment Station, Peradeniya, and has recommended the provision of adequate factory accommodation for dealing with its crops. Provision has been made for a small dairy attached to the Agricultural School at Peradeniya and for the building of a Chemical Laboratory for the Department.

The amendment and consolidation of the Plant Pest and Disease legislation has received special attention during the year and the amending Ordinance, as approved by the Board of Agriculture, is now before the Legislative Council.

Detailed reports on Pests and Diseases from the Mycological, Entomological and Inspecting Divisions of the Department are appended.

REPORT OF MYCOLOGICAL DIVISION.

TEA.

The chief disease of tea which has attracted attention during the year is that known as the Witches' Broom disease. This is characterised by the production of shoots in clusters from the old wood, usually after pruning. Some of the shoots die, and others arise from the main stem at their bases, ultimately forming a brush of dead and living twigs up to a foot or more in length. The disease is apparently of slow development, and its full course has not yet been observed. It is prevalent on the Eastern side of the hills, though examples have been received from other districts. The cause has not yet been ascertained. Investigations on this disease were carried on by DR. BRYCE up to the time of his departure from Ceylon, and they are now being resumed by MR. PARK.

The tea seed crop of 1923 was to a large extent a failure. This was the case, not only on the western side of the hills, where the failure was usually attributed to the excessive rainfall, but also on the eastern side where the usual dry weather prevailed. In the latter case, the failure appeared to be due to the fact that the husk did not dry and split when the seed was ripe, with the consequence that the seed remained on the tree until it was too old to germinate.

RUBBER.

Leaf fall and pod disease were prevalent during the prolonged rains but opinions appear to differ as regards the severity of the disease compared with previous years. A comparative study of the Phytophthoras on *Hevea*, cacao, breadfuit, papaw, *Dendrobium* and *Odontadeniya* has been made by Mr. Gadd. Though there are differences between the strains from the different plants, it would appear that they are all to be regarded as biological forms of one species viz. *Phytophthora Faberi*. All of them can attack Hevea fruits.

Cases have been observed of the occurrence of *Fomes Lucidus* on *Hevea* roots under conditions which suggest that this fungus can cause root disease. It is known to cause root disease of coconuts and other palms in Ceylon, and of tea in Northern India. Investigations on this have been begun.

COCONUTS.

The number of disease specimens of coconuts has shown an increase during the year. These have been chiefly Grey Blight, but the increase is notable as indicating a greater interest in diseases of the coconut palm, especially among the smaller estate proprietors.

Mr. Gadd has continued observations on the fall of immature nuts, and the effect of spraying on the fall of such nuts. The *Phytophthora* nut-fall has not been found during these investigations, and the nut-fall observed appears to have been due solely to physiological causes. As was to be expected under these circumstances, the experiments in spraying with Bordeaux mixture did not show any definite advantage. An article on this subject has appearance in the Year-book of the Department of Agriculture.

REPORT OF ENTOMOLOGICAL DIVISION.

TEA.

The most noticeable feature in regard to tea pests during the year has been the greatly increased interest in the various species of termites which are known to attack tea. It is certain that these pests are on the increase in many districts. Improved methods of destroying the colonies of Calotermes species in the bushes, and those of the scavenging termites in mounds and underground nests, are urgently desired. In regard to the scavenging termites the removal from the bushes of all dead and diseased bark and wood, caused by branch canker, and the eradication of dead tree stumps, upon which these termites feed, is urged if the damage due to these insects is to be reduced.

The special investigation of shot-hole borer (*Xyleborus fornicatus*) has been continued and particularly promising results have been obtained in greard to the control of this pest by cultural methods. New experiments

have been commenced near Peradeniya with individual manures to confirm the results obtained in previous preliminary experiments. The trials with Castor (*Ricinus communis*) as a trap-tree for this pest have been abandoned as they failed to indicate any reduction in the numbers of borers in the interplanted areas.

The Tortrix (*Homona coffearia*) continues to be a troublesome pest in certain localities and few attempts have been made to establish flight breaks preparatory to controlling this pest by spraying with lead-chromate. Several outbreaks of other leaf-eating caterpillars have occurred in various districts but none of them have been of a serious nature.

Green bug (*Coccus viridis*) and brown bug (*Saisselia hemispherica*) have been prevalent during the year particularly in the Haputale district where they are considered to be on the increase and to be the cause of a considerable loss of crop.

COCONUTS.

The coconut leaf caterpillar (*Nephantis serinopa*) is extending its sphere of activity and new records have been received during the year from Badulla, Jaffna, Kelani Valley and Peradeniya. This pest has been successfully controlled on certain estates by the pruning and burning of infested leaflets at the commencement of the attack and has increased where no such measures have been adopted.

Severe damage was caused to young coconuts on an estate in the Eastern Province by the paddy swarming caterpillar, which has not previously been recorded as attacking coconuts.

Few complaints have been received regarding the rhinoceros beetle (*Oryctes rhinoceros*) and the red Weevil (*Rhyncophorus ferrugineus*) but several minor pests of coconuts have been recorded during the year.

COTTON

Outbreaks of the cotton leaf-caterpillar (*Cosmophila erosa*) occurred in the Southern and Northern Provinces but were promptly controlled. The leaf folder (*Sylepta derogata*), the boll-worm (*Earias* sp.) and the strainer (*Dysdercus cingulatus*) have also been reported as damaging this crop.

CACAO.

Considerable damage was caused in the Kandy district to plants in a cacao nursery by the larvae of *Euproctis* sp. and other pests of this crop have been reported.

GREEN MANURE TREES.

Tephrosia candida has been damaged by *Ceroplastodes cajani*, and the pod borers *Etiella zinckenella* and *Araecerus fasciculatus*? Dadap by the stem borer *Terastia meticulosalis* and plant sucking bugs; Albizzia, by the Nettle grub (*Thosea cana*) *Terias* sp. and bagworms (*Psychidae*), and *Gliricidia maculata* and *Leucaena glauca* by the Coccid (*Pseudococcus virgatus*).

MISCELLANEOUS.

PADDY.

Several outbreaks of paddy swarming caterpillar (*Spodoptera mauritia*) occurred in the Eastern Province towards the end of the year and damage by other pests has been reported.

Plantains have been damaged by the root borer (*Cosmopolites soddidus*) and the stem borer (*Odoiporus longicollis*). The larvae of *Papilio polytes* have completely defoliated citrus trees and the fruit has also been damaged by the fruit-fly (*Dacus ferrugineus*). Green bug (*Coccus viridis*), red borer (*Zeuzera coffeae*) and the Scolytid (*Xyleborus compactus*) have been reported from coffee, and grass lawns and pasture have been severely damaged, in many districts, by the larvæ of *Pachyzancla phoeopteralis*.

The snail (*Achatina fulica*) is extending its range to new districts but is considered to be less prevalent in the Kandy district as compared with former years.

PLANT PESTS AND DISEASES INSPECTION.
REPORT OF CENTRAL DIVISION.

During the year 47, 794 acres of tea have been inspected, comprising 157 estates, 196 gardens and 19 nurseries. Seventy two estates and two hundred and six gardens have been scheduled as areas infested as areas with Shot-hole Borer. There is evidence that the area in which this pest occurs is widening and that it has made its appearance in two districts which were previously free. Every care has been taken to prevent its dissemination by the sale of plants, but, as it is exceedingly difficult to check the illicit sale of plants without permits, there is a continual leakage of borer-infested stumps throughout the tea growing area. The total number of plants sold under permit during the year was 2,093,500.

Tea Tortrix was again general, especially on mid and low country estates. It caused severe damage to nursery plants. Those estates which possessed knapsack sprayers were able to save nursery stock by carrying out control measures.

From experiments carried out during the last three years it has been found that tea cannot be recommended as an adequate flight break, for, owing to the lack of uniformity of jat on all tea estates large and numerous gaps appear in the line of breaks. Trials will be made with quick growing plants of manurial value and timber and fuel trees.

Helopeltis was recorded on eighteen occasions, but was checked before any material loss of crops occurred.

The presence of *Calotermes militaris* was recorded on ten estates during the year.

The Inspectorate has been in continual and close touch with the small cultivator. Illustrated posters in the Vernaculars of the major pests together with leaflets have been distributed amongst them.

The Banana Root Weevil and a bacterial disease of Betel Vine have received special attention.

REPORT OF SOUTHERN DIVISION.

Rubber.

Root diseases.—No exceptional outbreaks of root diseases have been noted through the year. *Fomes lingnosnus* is present on most estates and takes its yearly toll, but in most cases the deaths occur in or near well-known infected areas and very few new areas have been seen. The various other root diseases occur chiefly as isolated cases. Both *Ustulina zonata* and Brown root disease are very common but neither *Poria hypobrunia* nor *Sphacrostible repens* appear to do much damage.

Phytophthora disease.—Owing to the extremely heavy rainfall during the past year all forms of Phytophthora disease have been very prevalent. Secondary leaf-fall and pod rot started with the June rains and carried on well into August and September. In districts such as Kalutara and Kelani Valley which normally suffer considerably from this disease the attack was no more severe than that experienced in 1922. Ratnapura district, however, which normally does not experience bad attacks of secondary leaf-fall suffered fairly heavily this year. In the two former districts many estates must have lost at least 25 % of the normal foliage and it was the exception to find a seed capable of germination.

Owing to the almost general use of some form of disinfectant on the tapping cut, Bark rot was not nearly so prevalent as might have been expected although some cases did appear during the N. E. months in spite of all care in applying preventives.

Claret canker has been very prevalent on all estates and during the coming dry weather this disease should receive careful attention.

Brown Bast.—This much discussed disease does not appear to be increasing at all rapidly and if, as is generally thought now, the disease is a physiological one, the resting and light tapping consequent on restriction should tend to keep new cases of this disease down to a minimum.

Other Stem Diseases.—Pink disease still continues to be prevalent in the younger rubber areas, i. e. rubber 3—4 years old, but is very seldom met with in older rubber. The damage caused by Dieback (*Botrydiplodia theobromae*) during the past year has been very slight.

MINUTES OF MEETINGS OF THE BOARD OF AGRICULTURE.

Minutes of a Meeting of the Board of Agriculture held on Thursday, March 13th, 1924, at 10 a.m. at the Victoria Commemoration Buildings, Kandy.

His Excellency the Governor presided :

Present:—The Hon. Mr. F. A. Stockdale, Director of Agriculture ; the Hon. Mr. W. L. Kindersley, Government Agent, Central Province ; the Hon. Sir Marcus Fernando, Messrs. D. S. Cameron, J. Græme Sinclair, J. B. Coles, G W. Hunter-Blair, N. G. Campbell, Graham Panditteseker a, R. A. Senior White, G. G. Auchinleck, Divisional Agricultural Officer, Central, G. Harbord, Divisional Agricultural Officer, Northern, F. Burnett, Divisional Agricultural Officer, Southern, G. E. Jayatilleke Hulugalle, Divisional Agricultural Officer, N.W.P., Oswald Balean, C. B. Loudon Shand, John Horsfall, John A. Coombe, A. S. Long Price, Allan Coombe, S. Muttutamby, Albert A. Wickremasinghe, J. E. P. Rajapakse. A. F. B. Smeaton, T. A. de Mel, Gate Mudaliyar L. A. Dassanaike, Mudaliyars W. A. Ameresekere, Edmund Peiris, George A. Goonetilleke, Messrs. T. Walloopillai, R. O. Iliffe, Economic Botanist and T. H. Holland, Manager, Experiment Station, Dr. J. C. Hutson, Govt. Entomologist, Messrs. E. M. Windus, E. Maberly Byrde, J. W. Oldfield, A. T. Sydney Smith, J. Sheridon Patterson, A. P. Waldock, S. Tyagaraja and A. W. R. Joachim, (Secretary).

Visitors :—The Hon. R. Trefusis, Private Secretary to His Excellency the Governor ; Messrs. John Grieg, Alex. Stent, Chas. Gibbon, Jas. D. Dunlop and Mr. G. B. Foote.

Letters or telegrams expressing inability to be present were received from :—The Hon. the Controller of Revenue ; Hon. Mr. Jas. Peiris, Gate Mudaliyar A. E. Rajapakse ; Hon. Mr. H. L. De Mel, C. B. E., Messrs. A. W. Beven, A. Dyson Rook, A. J. Austin Dickson, C. W. Bibile, D. S. Senanayake, A. C. Yates M. K. T. Sandys, Asst. Govt. Agent, Mullaittivu, N. D. S. Silva ; M. Kelway Bamber, C. Drieberg and Mudaliyar S. P. Wijetunga.

The minutes of the previous meeting held on November 21, 1923, were taken as read, and confirmed.

Agenda Item No. 2.—Appointment of Standing Committees.

The Director of Agriculture proposed that the following Standing Committees be appointed :—

EXECUTIVE COMMITTEE.

His Excellency the Governor, *President*
The Hon. the Colonial Secretary, *Vice-President*
The Hon. the Controller of Revenue
The Hon. the Director of Agriculture
The Hon. the Member for the European Rural Electorate
The Hon. Sir H. M. Fernando
The Chairman, Planters' Association
Mr. J. B. Coles
Mr. R. G. Coombe
Dr. W. A. de Silva
Mr. C. E. A. Dias

ESTATE PRODUCTS COMMITTEE.

The Hon. the Director of Agriculture, *Chairman*
The Hon. the Member for the European Rural Electorate
The Hon. Sir H. M. Fernando
Mr. O. Balean
Sir S. D. Bandaranaike
Mr. A. W. Beven
Mr. G. W. Hunter-Blair
The Botanist and Mycologist
Mr. E. Maberly Byrde
Mr. D. S. Cameron
Mr. N. G. Campbell
The Chairman, Ceylon Planters' Association
Mr. J. B. Coles
Mr. Allan Coombe
Mr. R. G. Coombe
Mr. H. P. Daniell
The Hon. Mr. H. L. De Mel, C.B.E.
Mr. T. A. de Mel
Mr. Wace de Niese
Dr. W. A. de Silva
Mr. C. E. A. Dias
Mr. A. J. Austin-Dickson
The Divisional Agricultural Officer, Central
The Entomologist
Mr. A. A. Franklin
Mr. H. D. Garrick
Mr. H. W. Gavin
The Government Veterinary Surgeon
Mr. John Horsfall
Mr. E. W. Keith
Mr. A. S. Long Price
The Manager, Experiment Station, Peradeniya
Mr. W. R. Matthew (on leave) Mr. C. C. Durrant (acting)
Mr. J. Graeme Sinclair
Mr. Graham Panditteseker a
Mr. J. Sheridon Patterson
The Hon. Mr. James Peiris
Mr. J. E. P. Rajapakse
Gate Mudaliyar A. E. Rajapakse
Mr. M. H. Reeves
Mr. A. Dyson Rooke
Mr. D. S. Senanayake
Mr. C. B. Loudon Shand (on leave Mr. E. M. Windus (acting)
Mr. N. D. S. Silva
Mr. A. F. B. Smeaton
Mr. A. T. Sydney Smith
Mr. A. P. Waldock
Mr. L. A. Wright
Mr. A. C. Yates
Secretary : Mr. T. H. Holland.

FOOD PRODUCTS COMMITTEE.

The Hon. the Director of Agriculture (*Chairman*)
The Hon. the Member for the European Rural Electorate
The Hon. Sir H. M. Fernando
Mudaliyar W. A. Amarasekera
Mr. C. W. Bibile, Ratemahatmaya
Gate Mudaliyar L. A. Dassanaike
The Hon. Mr. H. L. De Mel, C.B.E.
Dr. W. A. de Silva
Mr. C. E. A. Dias
Mr. C. Drieberg
The Divisional Agricultural Officer, Central
The Divisional Agricultural Officer, Southern
The Divisional Agricultural Officer, Northern
The Divisional Agricultural Officer, North-Western
The Economic Botanist
Secretary to the Board: Mr. A. W. R. Joachim

Mudaliyar E. F. Edirisinghe
Government Veterinary Surgeon
Mudaliyar G. A. Gunatillake
Mudaliyar K. V. Markandan
The Hon. Mr. J. H. Meedeniya
The Hon. Mr. T. B. L. Moone malle
Mudaliyar S. Muttuthamby
Mr. P. B. Nugawela
The Hon. Mr. James Peiries
Mudaliyar Edmund Peiris
Gate Mudaliyar A. E. Rajapakse
Mr. A. Sabapathy
Mr. M. K. T. Sandys
Mr. D. S. Senanayake
Mr. N. D. S. Silva
Mr. S. Tyagarajah
Mudaliyar S. P. Wijetunga
Mr. T. Walloopillai
Mr. R. A. Senior White
Mr. A. A. Wickramasinghe
Secretary: Mr. N. Wickramaratne

and asked for further suggestions. There being none forthcoming the Committees, as so constituted, were unanimously approved.

Agenda Item No. 3—The Scope for Dairy Farming in Ceylon by Sir Marcus Fernando, M.D.

SIR MARCUS FERNANDO read his paper on the "Scope for Dairy Farming in Ceylon," which had previously been circulated among members. In it he dealt with the main causes that contributed towards the extremely poor condition of Ceylon cattle generally and dairy cattle in particular. He also outlined two methods whereby the milk yield of Ceylon cows could be improved—one by selective type breeding and the other by mating cows of one breed to a pedigree stud bull of known milk strain. In the Government breeding and dairy farms in India these lines of selective breeding had been practised, and noteworthy results had been obtained. Similar work had been started in Ceylon recently.

The great problem in Ceylon was the question of fodder grasses. There was also the question of cattle disease, viz., rinderpest and foot and mouth disease. There was however ample scope in Ceylon to breed an improved type of milch cattle by appropriate selective methods.

The Director of Agriculture, speaking next, emphasised the importance of the subject matter of Sir. MARCUS FERNANDO's paper to the country. He said that crossing between cattle of European and Indigenous stock had to be undertaken with caution. At Peradeniya a small dairy had recently been started for instructional purposes under the School of Agriculture and experiments were being carried out with Scind cattle specially selected for the Agricultural Department. With regard to fodder grasses, he stated that the Department had given attention to this matter for several years and that at Peradeniya and Jaffna successful experiments had been carried out—in the latter place with one of the sorghums. The whole question of dairying turned on the successful growing of fodder.

His Excellency the Governor after thanking Sir. Marcus for his interesting paper offered some very valuable comments on the subject. With regard to the milk supply of Colombo, he said that it was far from what he thought clean. This was due, as Sir. Marcus had said, to the fact that the quality of the cattle was poor and the grazing worse. In India, although extensive experiments had been carried out in cattle breeding, the strain of cattle in the villages was often inferior to those found in Ceylon. A great deal was talked in the country on the necessity for the improvement of cattle breeding, but little was done. Though some good may have resulted as a result of crossing experiments so far as the herds of cattle in the hands of estate owners went, no tangible results were noticed in the herds that roam about the roads. He agreed with Sir Marcus that there were too many cattle in Ceylon, many of these being starved and disease stricken. So long as the whole country was overrun with the wretched breed of cattle one found so rampant, there was very little chance of improving the dairying of this country.

Sir. Marcus replied briefly and the discussion was closed.

Agenda Item No. 4—Declaration of Pests and Diseases under the Amending Plant Pests Ordinance.

The Director of Agriculture in moving the declaration of pests and diseases under the Amending Plant Pests Ordinance, said that this Bill was before the Legislature and would come up for discussion some time this month. He had put the item on the Agenda in order to seek the advice or (and) sanction of the Board to the proposals now submitted. The following was the list which the Mycologist, the Entomologist and Plant Pest Inspectors had submitted should be declared under that Ordinance :—

1. Shot-hole Borer of Tea
2. Black beetle of Coconuts
3. Red weevil of Coconuts
4. Coconut Caterpillar
5. Bud Rot of Coconuts caused either by Bacillus Coli or by a species of Phytophthora.
6. Bunchy-top disease of Plantains
7. Red Weevil of Plantains
8. Soft-rot of Betel.

The first five of these had already been declared pests. It was thought desirable to add the last three as the diseases of plaintain were spreading throughout the Island, and the soft-rot of betel was common in the low country. The motion of the Director of Agriculture was carried.

The meeting then terminated.

A. W. R. JOACHIM,
Secretary,
Board of Agriculture.

MINUTES OF MEETING OF ESTATE PRODUCTS COMMITTEE OF THE BOARD OF AGRICULTURE.

Minutes of the 18th Meeting of the Estate Products Committee of the Board of Agriculture held at the School of Tropical Agriculture, Peradeniya, at 10. a.m on Saturday, March 15th, 1924.

Present.—The Director of Agriculture (Chairman), the Government Botanist and Mycologist, the Government Agricultural Chemist, the Government Entomologist, the Divisional Agricultural Officer, Central Division, Messrs. John Horsfall, C. C. Durrant, J. S. Patterson, N. G. Campbell, J. B. Coles, A. T. Sydney Smith, A. Coombe, D. S. Cameron, J. Graeme Sinclair, A. P. Waldock, J. W. Oldfield, A. F. B. Smeaton, E. M. Windus, E. W. Keith, H. D. Garrick and T. H. Holland (*Secretary*).

As visitors.—MESSRS. F. P. JEPSON and A. WILKINSON. Before commencing the business on the agenda the CHAIRMAN said that this was the first meeting of the new Committee which had been elected at the Board of Agriculture Meeting on March 13th. He wished to thank the members of the old Committee who had given him the benefit of their advice and assistance during the last three years. He welcomed the new members to the Committee.

The minutes of the last meeting were confirmed.

Agenda Item 1 and 2. Progress Reports of the Experiment Station, Peradeniya, for the months of November and December, 1923, and January and February, 1924.

The CHAIRMAN briefly reviewed these reports.

MR. NEILL CAMPBELL in referring to the coppicing of coffee said that it was a recognised fact in the coffee days that coppiced Arabian coffee would only yield one crop subsequent to coppicing.

MR. JOHN HORSFALL in referring to *Indigofera endecaphylla* said that he had been advised to sow the seed in nurseries and then plant out cuttings from the nurseries.

Agenda Item 3. Manurial experiments on the Experiment Station, Peradeniya for 1923.

MR. M. KELWAY BAMBER briefly commented on the statement of yields which had been circulated to members. He remarked that the hard pruning in 1921 had greatly depressed the yields which were now however gradually returning to normal.

The low rainfall of 1921 was partly responsible for the poor recovery after pruning.

Agenda Item 4. Rubber manurial experiments on the Experiment Station, Peradeniya for 1923.

MR. KELWAY BAMBER commented on the figures which had been circulated to members. He detailed the costs of the applications, compared them with the value of the increases in yield, if any, obtained, showing that in these experiments the manurial applications had in no case been profitable, nor had the growth been improved by the manuring.

The CHAIRMAN asked MR. J. W. OLDFIELD to give the meeting details of some manurial experiments carried out on the estate under his charge.

MR. OLDFIELD said that he had been led to furnish an account of these experiments by the statement made in Bulletin 68 that no manurial experiments on rubber had, to the knowledge of the writers, indubitably proved that the application of manures had increased the yield. He could not agree with that view. MR. OLDFIELD then gave the details of his experiments with nitrate of soda. The primary object had been to note the effect of this manure on leaf fall, but striking and immediate increases in yield had been obtained in the blocks where the soil was poor, and lesser increases on better soil. The increases on the poor soil amounted to ½ lb. of dry rubber per tree and on the better soil to ¼ lb. per tree.

In reply to MR. BAMBER, MR. OLDFIELD stated that 5 cwt. per acre of nitrate of soda had been applied in two applications at an interval of 4 weeks.

The CHAIRMAN thanked MR. OLDFIELD for his interesting information.

With regard to DR. BRYCE and MR. GADD's conclusions as set out briefly in the Departmental Year-book, he thought that the position was that where conditions were such as to allow a tree to produce its maximum natural yield manuring would not increase the yield. Where however conditions were not favourable, as in the case of the poor soil in MR. OLDFIELD's experiments, manuring might bring about conditions which would allow the tree to give its maximum yield; beyond this it would have no effect.

MR. GRAEME SINCLAIR said that he was also arranging for trials with nitrate of soda.

Agenda Item 5.—Rubber Tapping Experiments on the Experiment Station, Peradeniya, for 1923.

MR. HOLLAND commented on the report which had been circulated to members. In conclusion the CHAIRMAN mentioned that tapping experiments were also in progress at Henaratgoda in which individual yields of trees were being recorded. He also asked for suggestions for further experiments in three plots grown from the seed of No. 2 tree Henaratgoda on the Experiment Station, Peradeniya; he was in favour of keeping individual yields on this plot. This suggestion was approved by the meeting.

Agenda Item 6.—Report of the Sub-Committee of the Board of Agriculture on Soil Erosion.

The CHAIRMAN read the Sub-Committee's report. MR. D. S. CAMERON who had not been present at the meeting had dissented from para 4 of the report.

MR. JOHN HORSFALL proposed an amendment which he thought would deal with MR. CAMERON's objection. The report was adopted by the meeting with para 4 amended to read as follows :—

"That in cases where it is in the interest of the State, as determined by the Forest Department that privately owned lands, steep in slope or in catchment areas of important rivers or streams, should be under forest, the Government should be asked to encourage the planting up of such lands by the issue free to the owners of such lands of the necessary seeds or plants for planting them up and (or) to make monetary grants to such owners for their planting in forest."

MR. A. P. WALDOCK spoke on the need of a bulletin giving information to agriculturists as to the most suitable species of trees for fuel and timber purposes. Other members said that they had experienced difficulty in obtaining the information and also the seeds required. The CHAIRMAN said he fully recognised the need for a bulletin giving the accumulated experience of the Forest and Agricultural Departments in this matter. He had already approached the Conservator of Forests on the subject and would endeavour to get such a publication made available.

Agenda Item 7 — Bulletin No. 68. Yield and Growth of Hevea Brasiliensis.

The CHAIRMAN stated that this bulletin had been published and had been circulated to subscribers.

An extra item was, with the permission of the meeting, placed on the agenda at the instance of MR. A. P. WALDOCK, namely.—

"THE PARASITIC CONTROL OF SHOT-HOLE BORER."

MR. WALDOCK read an extract from the NATIONAL GEOGRAPHICAL MAGAZINE describing MUIR'S eventually successful search for a parasite of the sugar-cane borer in Hawaii. He said that he could find no mention in the Departmental publications of the question of the parasitic control of shot-hole borer though he understood that the point had been considered.

MR. JEPSON gave a brief account of the position in Ceylon. Two attempts had been made to introduce parasites. In 1909 or 1910 GREEN had endeavoured to introduce a beetle which preyed upon a borer in Pine forests in Scotland. Though some larvæ were landed alive they did not thrive and the attempt was not successful.

In 1915 SPEYER introduced a predacious beetle but no further records were available. More recently communications had been addressed to Java regarding a possible parasite from that country.

The Java authorities were, however, not hopeful as to success with the species in question.

The CHAIRMAN said that it was now recognised that the control of pests by the multiplication of parasites which were already in the country was not usually successful; it was therefore necessary to look to other countries for parasites and to import them. Shot-hole Borer had only recently attracted attention in Java and no parasite likely to be of benefit to Ceylon had as yet been found. Further communication would however be made with Java. There was at present no authentic record of Shot-hole borer in tea in South India.

T. H. HOLLAND,
Secretary, E. P. C.

MINUTES OF MEETINGS OF FOOD PRODUCTION COMMITTEES.

MANNAR.

Minutes of the Mannar District Food Production Committee Meeting held at the Murungan Resthouse on March 5th, 1924.

Present.—Mr. C. L. Wickremesinghe, Assistant Government Agent, Mannar (in the chair): Mr. G. Harbord, Divisional Agricultural Officer, N.D.; Mudaliyar S. Muttutamby, District Adigar, Mannar; Mr. A. R. James, District Adigar, Mantai: Mr. S. M. P. Arulappah, District Adigar, Musali, Mr. G. Syms, Assistant Irrigation Engineer, Giant's Tank: Mr. A. E. Scheffer, Irrigation Superintendent, Giant's Tank; Mr. V. Ramanathan, Agricultural Instructor; Revd. Fathers N. Santiago and J. Francis, Messrs. A. L. Savundranayagam, A. Seemampillai, M. S. Hamid, I. Vinasitamby, K. Neina Mohamado, A. Zactassi Croos, Ana Una Habibu Mohamado, Marisal Santan, A. N. Mohamado Muthalawawa and the Secretary Mr. P. Ponniah Hubert, Kachcheri Mudaliyar.

1 The CHAIRMAN intimated that in view of the fact that the maximum irrigable extent under Giant's Tank has already been reached and of the difficulty of obtaining sufficient labour to develop even the existing lands, an increase in food production can only be expected by the adoption of better methods of cultivation, and initiated a discussion. After discussion it was resolved that :—

(A) The Assistant Government Agent be requested to have the existing rules in respect to stray cattle and cattle trespass rigorously enforced as cultivators suffered considerable damage owing to cattle trespass.

(B) The adoption of improved methods be popularized.

(1) By organising, whenever possible, competitions under the following heads :—

(a) Green manuring
(b) Manuring with other manures
(c) Weeding
(d) Transplanting
(e) Seed selection

(2) By Committee members undertaking similar demonstrations with the assistance of the Agricultural Department.

(3) By demonstration at a central station.

Re (B) (1) The Committee desired that at the start only green manuring competitions be organised for next Kalapokam in Nanaddan East, Nanaddan West, Mantai South and Mantai North.

Re (B) (2) Committee members present expressed their willingness to undertake suitable demonstrations.

Re (3) The Divisional Agricultural Officer intimated that the Director of Agriculture has agreed to sanction the establishment of such a station probably at Uyilankulam.

2 The Divisional Agricultural Officer initiated a discussion on the aim and objects of village cattle.

3 It was pointed out that cultivators are required to pay royalty for satin and palu timber required for ploughs. The Committee were of opinion the necessary timber should be issued free. The CHAIRMAN promised to consider the matter as Assistant Government Agent.

4 The members were unanimously of opinion that the cultivation was greatly hampered and that the further development of cultivation almost impossible owing to the absence of proper roads. They recommended that the following programme be placed before Government :—

(1) Improvement and metalling of the following roads :—
- (a) Vankalai-Nanaddan minor road
- (b) Nanaddan-Arippu minor road
- (c) Murungan-Nanaddan minor road
- (d) Adampan-byilankulam minor road
- (e) Silavaturai-Murungan minor road
- (f) Mantai-Alkaddiveli-Parapukadatan minor road
- (g(Uyilankulam-Nanaddan minor road

and that if they cannot be taken over by the Public Works Department.—

(2) Government be requested to give suitable grants to the District Road Committee for their improvement and better maintenance as agricultural roads.

COLOMBO

Minutes of a meeting of the Food Production Committee of the Colombo District, held at the Colombo Kachcheri on Thursday the 14th, February, 1924 at 10 a.m.

Present :—The Hon. the Government Agent, W. P. (in the chair), Dr. W. A. de Silva, J.P., Mr. D. C. Senanayaka, Gate Mudaliyar L. A. Dassanaike (Mudaliyar. Hapitigam Korale), Gate Mudaliyar C. H. A. Samarakkody (Mudaliyar, Alutkuru Korale North,) Mudaliyar T. F. Abeykoon (Mudaliyar, Alutkuru Korale South), Mudaliyar D. C. R. Wijesinghe (Mudaliyar, Siyane Korale West), Mohandiram Maurice Perera (Acting Mudaliyar of Colombo), Mudaliyar A. E. Abhayratne (Mudaliyar, Hewagam Korale), Mudaliyar J. P. Obeyesekera (Mudaliyar, Siyane Korale East), Mudaliyar C. W. de Fonseka (Mudaliyar, Salpiti Korale) and Atapattu Mudaliyar W. A. Samarasinghe, who acted as Secretary,

1. The minutes of the previous meeting were taken as read and confirmed.

2 The President read letter from the Director of Agriculture No. 2370/1457 of 17. 10. 23. intimating that a sum of Rs. 400/- had been allocated to the Colombo District in aid of Shows and Competitions. After discussion it was decided that half the allocation (viz: Rs. 200) be offered as prizes for Competitions to School Gardens in the Colombo District and the remaining half (Rs. 200/-) be granted in aid of the Village Show to be held at Attanagalla.

The prizes to be awarded for Competition among schools were to be as follows :—

1st Prize Rs. 25/-
2nd Prize Rs. 15/-
3rd Prize Rs. 5/-

for the three best School Gardens in each Korale according to merit.

This will involve an expenditure of Rs. 45/- in each Korale or a total expenditure of Rs. 360/- in the 8 Chief Headman's Divisions. The difference between the amount and the amount allotted from the vote was decided to be met from the funds of the Colombo Horticultural Society which are in charge of the Hon. the Government Agent, W.P. It was also resolved that select seeds be obtained from Messrs. Poocha & Sons, Poona, for distribution to the competing schools, of the following varieties of vegetables, viz : Radishes, Snake Gourd, Brinjals, Chillies and Capsicums.

3. A summary of replies received from Mudaliyars to a Circular enquiring what was the present state of Food Production and of the Peruwa Food Production Committee was read for information. It transpired that Food Production in the District was satisfactory and that the Peruwa Food Production Societies created at the time of the rice scarcity had almost entirely died out because there was no business of any practical importance to engage their attention.

The meeting terminated with a vote of thanks to the chair.

PROGRESS REPORT OF THE EXPERIMENT STATION, PERADENIYA

For November and December, 1923.

TEA.

The pruning of the whole area was completed. In the six plots which are sub-divided into half acre plots for manurial purposes one branch in each bush was left unpruned in the B. plots while the A. plots were pruned in the ordinary manner. In plots 141, 142 and 143 (Singlo and Assam Indigenous jat) no particular difference in the recovery of the bushes can be noted. In plots 146, 147 and 148 (Dark Leaf Manipuri jat) the B. plots show a distinct improvement over the A. plots. In the case of plot 148 B. this might be attributed to the fact that this plot receives a complete manurial mixture whereas plot 148 A. receives groundnut cake only. In the cases of 146 B. and 147 B. it would be hard to attribute any improvement to the manurial mixture.

The pruning mixture of 100 lb. Basic slag and 60 lb. Sulphate of Potash per acre was applied throughout.

In the Hillside tea clearing 6 new drains were put in and some of the old drains deepened and enlarged.

Other tea drains were cleaned. Weeding was in arrears but was got up to date at the end of December.

RUBBER.

A complete census of trees affected by Brown Bast and other diseases was taken in December. In some cases interesting figures were obtained. These will appear in the reports on the experiments concerned.

Some new drains have been put in to the Avenue rubber. Terracing in the Hillside rubber has been repaired. Continuous rain in December greatly interfered with tapping.

CACAO.

The crop is extremely poor and is at present approximately 1 cwt. per acre below last year's crop. The proportion of diseased pods is very large. Bark canker treatment was postponed till more favourable weather.

There seems little doubt that Kalutara snails devour the blossom found on the stems of trees and this must result in a considerable loss of crop. They are seldom seen on the branches. Some alterations and improvements were made to the fermenting tanks with a view to commencing experiments in January.

COFFEE.

In the Quillon and Uganda plots which are shaded by dadaps new dadap cuttings were planted with a view to the eventual removal of the old trees.

Plot 140 E (Robusta) was treated as per plan viz., 1/3 area cattle manure and forking; 1/3 heavy mulch and no cultivation; 1/3 area plain forking.

The result of collar-pruning this plot in January 1922 has not been a complete success. The new bushes formed by leaving one good sucker have grown rapidly and are now bearing berries. They have not however been free from die back and lateral branches are very sparse. It would probably be better to let two suckers grow up and this will be tried when opportunity offers.

The condition of 6 acres of Jackson's Hybrid and Kent's Arabia coffee is far from satisfactory. Many bushes are dying out in the poorer portions and leaf disease is prevalent. It is thought that insufficient shade may be a contributory cause and a row of Lucæna glauca has been planted between each row of Gliricidia. It will probably be necessary to substitute Hybrid or some other hardy variety for the Arabian in the upper and poorer portion of this land.

Kalutara snails have been observed eating coffee blossom and a periodical collection of snails in the coffee plots was commenced.

GREEN MANURES AND COVER PLANTS.

Two years' records of loppings obtained from Gliricidia and Dadap trees of the same age planted in tea give some interesting figures which are set out in the following table :—

	Gliricidia,	*Dadap*.
Weight of green loppings per tree per year.	141 lb.	90 lb.
Percentage of Organic matter in fresh loppings (from Government Agricultural Chemist's analysis).	29·2 %	10·4 %
Weight of green loppings per acre planted 16 in by 16 in	13·6 Tons	7·2 Tons.
Weight of organic matter per acre	2·7 „	·7 „

It will be seen that the Gliricidia has supplied nearly 4 times the quantity of organic matter per acre supplied by the Dadap.

Reports received from Norwood and Dimbulla indicate that Gliricidia is inferior to the Dadap in those districts and it does not appear to be very suitable for the higher elevations in districts which get the South-west monsoon.

Attempts to propagate Indigofera Endecaphylla from cuttings have not proved very successful. Only a few cuttings have struck and growth is very slow. Propagation from seed would appear advisable. The original Show plot of this plant flowered and a good quantity of seed has been set.

Propagation of Vigna Oligosperma from cuttings has so far almost completely failed. The plant has not flowered yet, so that further multiplication is held up.

The plot of Centrosema Pubescens has made fair growth and the plant appears quicker and easier to establish than Centrosema Plumeri. On the other hand some seed sown in a very steep bare washed slope has failed almost completely.

Contour hedges of Indigofera arrecta in the Hillside tea are beginning to die out after a life of $1\frac{1}{2}$ years and 3 loppings.

ANNUAL ECONOMIC AREA.

The cultivation of this area was put in hand when the heaviest rains appeared to be over. The following crops have been sown :—

Cow peas 3 varieties	Sugar-canes (8 varieties)
Adlay (Coix jobi Lachrymæ)	Sweet potatos
Maize (2 varieties)	Buckwheat
Vetches (2 varieties)	

The whole area, which produced very poor crops for the first two seasons, received last year an application of cattle manure of approximately 16 tons per acre.

In addition some of the crops have now received artificial manures. The depradations of snails were largely responsible for some of the earlier failures and on this occasion a barrier of ashes or sand and copper sulphate has been maintained on the side from which snails approach. These precautions have proved successful and prospects for most of the crops are promising. Whether such measures are an economic possibility on a field scale will be shown when the cultivation sheets which are being maintained for these crops are complete and the crops disposed of.

PLANTAINS.

A small experiment in prevention of Bunchy Top by the use of

(a) Sulphur
(b) Sulphur and Phosphatic manures

has been inaugurated on the lines of an experienced plantain grower in Queensland who claimed success in the prevention of this disease.

COUCH GRASS AND ILUK.

All the available male labour during November and December was employed in forking out these two weeds which obtained a firm hold during the period of war retrenchment. 255 coolies were employed in this work but the round is not yet complete. Unless constant and unremitting attention is given to this work the position, now sufficiently bad, will become hopeless. Other urgent works have been postponed for this work which I consider of paramount importance. The problem is at its worst in the fodder grass plots two of which were reclaimed from a mixed growth of cheddy and iluk.

LABOUR.

Until additional line room and funds are provided to enable a larger permanent labour force to be maintained no great improvement can be looked for. The present labour force of a little more than ¾ cooly per cultivated acre is insufficient for the class of cultivation carried on and the weeds to be coped with. An experiment in eradicating a patch of iluk (without forking) is in progress in plot 23. This patch has been divided into 3 plots, 1 plot has been planted among the iluk with manioc cuttings, 1 foot apart, 1 plot with Ceara rubber cuttings in alavango holes, and one plot sown with mustard seed after cutting the iluk.

ADLAY *(Coix jobi Lachrymae.)*

A crop of this food grain harvested in December yielded 69 bush. or 2,484 lb. of grain per acre and 22,060 lb. of straw. This yield was obtained in plot C 4 of the Annual Economic area which as stated received a general application of 16 tons cattle manure per acre. Two previous crops of Adlay grown in this area yielded only about half this quantity of grain. Fifteen small lots of grain were distributed free to Experiment Station employees including Tamils, Sinhalese and Mohammedans. Some cooked and ate the grain as rice, some made the flour into the dish known by Sinhalese as "Pittu" and by Tamils as "Puttu" and some made it into "Roti." All expressed their approval of the grain as a food and their willingness to buy it when available. When it is considered that the food value is superior to rice, wheat or oats, and that yields as quoted above can be obtained, the grain appears to deserve considerable attention. A further area has been sown. Six varieties obtained from the Philippine Islands have also been harvested and the seed reserved for varietal tests. The straw is coarse but young bulls with good teeth will eat it.

ROSELLE FIBRE.

Two plots of this fibre were harvested during the period under review, the yields were respectively 1,617 lb. and 1,970 lb. of clean fibre per acre The average length of fibre was in one case 11·7 ft. and in the other 10·2 ft. Full details will be given in the Department Year-book. A trial plot has been reserved for seed which is now available.

RAINFALL.

The rainfall for November was 8·97 inches and for December 14·68 inches, making a total for the year of 116·08 inches compared with 83·27 inches for 1922.

T. H. HOLLAND,
Manager, Experiment Station, Peradeniya.

PROGRESS REPORT OF THE EXPERIMENT STATION, PERADENIYA

For the months of January and February 1924.

TEA.

Tipping was completed and all tea was in bearing at the end of February. The bushes are looking healthy. In February all the young bushes in the Hillside tea received one basket of old cattle manure per bush. This was first mulched on the surface and later forked in after the heavy shower of rain on February 25th.

RUBBER.

The staff in charge of this crop has been mostly employed in the calculation and preparation of figures of the experiments up to the end of 1923 in addition to the preparation of much additional material for the New Guide book of the Station.

CACAO.

Lopping of Dadap shade, pruning of Cacao and treatment of cacao stem-canker started in February. The light scraping and rubbing with copper sulphate crystals as a canker treatment is being continued as it appears to have been effective last year. A small picking was taken in February. A scheme of cacao fermenting experiments has been planned and two series completed in January. One cwt. of each lot has been shipped to England for examination by Messrs. Cadbury. Samples have also been sent to Colombo brokers whose reports are not all yet to hand. The experiments are not yet complete. A full report will be published in due course. A reward of Re 1 per sack for Kalutara snails resulted in the collection of over two tons of snails from the cacao plots.

COFFEE.

Picking of crop continued and a good many orders for seed were supplied.

COCONUTS.

The crop for 1923 from the old trees amounted to 25·2 nuts per tree. Of the nuts planted in different positions, twelve in each position, the following germinated :—Horizontal 6, Vertical 10, Slanting at about 45° 11. The plants have been planted out in Plot 161 B. for comparison of the growth and form of the trees.

FODDER GRASSES.

All the plots under experiment were manured with 10 cart-loads of old cattle manure per acre. This was spread on the surface and will be forked in later if labour is available, which at present seems very doubtful. The Efwatakala grass which was divided out in the Fruit plots in December 1923 has made excellent growth and has withstood the drought admirably. The Elephant grass (*Penniselum purpurascens*) which was similarly divided has mostly died out.

ANNUAL ECONOMIC AREA.

The crops planted in December which made a good start suffered froms the complete and unusually early cessation of rain after the first week of January; the situation was aggravated by the high wind which prevailed. The growth is stunted and the crops have matured prematurely.

ECONOMIC COLLECTION.

All young plants were mulched and the young Liberian coffee plants planted in last North-east monsoon were watered.

SUGAR CANES.

All canes in plots 19 and 20 were cut, the stumps were dug up and the trash burnt. Iluk has become re-established in these plots during the growth of the sugar-cane and it will be necessary to fork this out when labour can be spared before ploughing is done.

The fact that portions of some plots, and in three cases the whole plots, were cut in August 1923 renders the yield figures of less comparative value.

CALCULATED YIELDS IN TONS PER ACRE.

VARIETY.	1st crop* 1920-21 Annual Economic area.	1st crop 1921-22 Plots 19 & 20.	1st ratoon crop. Annual Economic area. 1921-22.	First ratoon crop. 1922-23 Plots 19 & 20.	Second ratoon crop.
1237 ...	37·8	21·7	17·0	22·4	16·4
55 P.	35·4	15·7	17·8	23·3	16·5
Sealy's seedling	45·8	18·2	17·6	—	—
131 P.	20·8	12·0	18·2	25·0	16·9
D. K. 74	21·8	42·7	18·3	25·0	—
3390	27·6	22·4	18·1	20·1	—
Striped Tanna	—	30·5	8·1	16·4	—
Striped White Tanna ...	14·1	20·1	7·3	—	—
Barbados 208	—	13·8	—	4·1	—
Red Top Mauritius ...	—	32·1	—	28·9	—
Sin Nombre	—	38·9	—	44·8	—

GREEN MANURES AND COVER PLANTS.

The *Vigna oligosperma* shows no sign of flowering.

The *Indigofera endecaphylla* started to die back partially with the commencement of dry weather but came on again at the first shower of rain. Seed has been collected. Seed of *Pueraria javanica*, another creeping leguminous plant which was sown last November, was at first thought to have failed but some plants have now appeared and show signs of making a good cover.

ROADS.

Good progress was made in laying foundations; carting of metal and gravel has been in progress.

GENERAL.

The employment of women in spreading cattle manure in the Hillside tea and grass plots resulted in the weeding falling in arrears, in January, but this was rectified by the end of February. It has been necessary slightly to reduce the village labour force on account of lack of funds. Forking of couch and iluk was suspended as the ground was too hard and the labour was required for other purposes.

All cheddy has been cleared in the coconut areas and elsewhere where required.

Thirty members of the Board of Agriculture visited the station on January 10th.

The Manager's and Assistant Manager's time has been largely occupied in compiling a Guide Book of the Station. This has now been completed.

The rainfall for January was 1·50 inches and for February 2·50 inches.

T. H. HOLLAND.
Manager,
Experiment Station, Peradeniya.

* These yields were calculated from only small areas.

HOME GARDENS COMPETITIONS, WALAPANE, 1923-24 SEASON.

These competitions were instituted in order to stimulate the production of vegetables in Home Gardens cultivated by the school boys, and to educate the future agriculturists of the district on scientific lines, and also to enable the school boys to apply the agricultural education received at school in practice.

For this purpose the competition was organised for the ten Government Vernacular Schools of the district.

The entries were as follows :—

	School.	*Entries.*
Oyapalata Korale	Pannala	13
do	* Batugolle	28
Yatipalata	Nildandahinne	19
do	* Madulla	6
Udapalata	Rupaha	15
Medapalata	* Kalaganwatte	15
do	* Udamadura	6
do	* Teripehe	14
do	Ilukkana	7
do	Arukwatte	10
	Total	133 entries.

Preliminary judging was carried out by the resident teacher and the teacher of the adjoining school, who submitted to me the names of the six best competitors from each school whose gardens were in their opinion most deserving of further consideration.

The final judging was to be carried out by a Committee consisting of the Agricultural Instructor of the district, Inspector of Home Gardens, resident teacher and with two village agriculturists. Unfortunately the visit of the Inspector of Home Gardens conflicted with my leave. The judging was carried out without the Inspector of Home Gardens. The six best home gardens of each school were visited and inspected by myself, resident teacher and with two village agriculturists, and the Committee picked out the three best gardens from each school.

The judges were guided by the consideration of the following when inspecting gardens : — System of cultivation, drainage, manuring, estimation of yield, freedom of diseases and tilth of soil.

LIST OF PRIZE-WINNERS AND AMOUNT OF PRIZES.

Pannala	1st. A. G. Sadris appu Rs. 5/-; 2nd. K. C. Heen Manika Rs. 3/-; 3rd. D. M. Appuhamy Rs. 2/-.
Batlagolle	1st. B. Punchirala Rs. 5/-; 2nd. T. Appuhamy Rs. 3/-; 3rd. A. Punchi Banda Rs. 2/-.
Nildandahinne	1st. B. Sudu Banda Rs. 5/-; 2nd. R. C. Banda Rs. 3/-; 3rd. W. Soysa Rs. 2/-.

* These schools have registered school gardens.

LIST OF PRIZE-WINNERS AND AMOUNT OF PRIZES.—*Contd.*

Madulla	1st. M. Siman Naide Rs. 5/-; 2nd. M. Punchi Naide Rs. 3/-; 3rd. B. Punchi Banda Rs. 2/-.
Rupaha	1st. B. Dharmasena Rs. 5/-; 2nd. E. W. Punchirala Rs. 3/-; 3rd. L. Appuhamy Rs. 2/-.
Kalaganwatte	1st. A. C. Punchi Banda Rs. 5/-: 2nd. B. M. Karunaratne Rs. 3/-; 3rd. G. G. Punchirala Rs. 2/-.
Udamadure	1st. W. M. D, Banda Rs. 5/-; 2nd. T. B. Galagoda Rs. 2/-; 3rd. B. C. Kiri Banda Rs. 2/-.
Tiripehe	1st. B. D. Udawela Rs. 5/-; 2nd. W. C. Punchi Banda Rs. 3/-; 3rd. H. S. Punchirala Rs. 2/-.
Arukwatte	1st. A. B. Pemaratne Rs. 5/-; 2nd. E. W. Sugendara Rs. 3/-; 3rd. T. G, Ukku Banda Rs. 2/-.
Ilukhinne	Gardens were abandoned due to poverty. This is the poorest village in the District.

Gardens cultivated with less than 1/16th of an acre and not more than 1/8th of an acre were eligible for competition. Pupils below 4th form were restricted. Each competition was restricted to each school : not more than 10 kinds of the named vegetables were to be cultivated and of which at least six kinds should be cultivated. The prize-winners of the respective schools had observed the rules laid down for the competition to their very best. This was due to the careful supervision of the teachers. I am very much impressed on the whole with the work of both the teachers and pupils. The advantages of competition of this nature was realised by pupils, teachers and parents. A distinct improvement was seen in the gardens cultivated by the boys attending schools having registered gardens. I am of opinion that other schools too should have registered gardens, at least the following :—Pannala, Rupaha, and Nildandahinne. Of this Pannala, and Nildandahinne have already sufficient accommodation for decent gardens. In case of Rupaha land will have to be acquired.

Up to the time of the final judging, the home gardens were visited often by me with the teachers. The competition being the first of its kind organised in the district, the improvement in the system of cultivation and entries are very satisfactory. I strongly feel in consideration of the great improvement it has effected this year, that this competition should be held annually.

A sum of Rs, 100/- was necessary for 10 first prizes of Rs. 5/-; 10 second prizes of Rs. 3/- and 10 third prizes of Rs. 2/- each. This sum was subscribed by a few of the planters of the district and by Mrs. G. G. Auchinleck and Mrs. E. T. Dyson.

GEO. MADUGALLE,
Agricultural Instructor, Walapane.

CO-OPERATION.

THE NEED FOR PRODUCERS' CO-OPERATIVE SOCIETIES IN CEYLON.

M. B. NEANGODA,

Secretary, Department of Agriculture Co-operative Society, Ltd.

Although provision has been made in the "Co-operative Societies Ordinance No. 34 of 1921" for the registration of non-credit Societies, so far little advantage has been taken by agriculturists of these provisions. The Co-operative credit movement is making steady progress in Ceylon but no attention, whatever, is being paid by our workers to the other branches of Co-operation which in Agricultural countries like Denmark, Ireland and America have been of immense benefit to agriculturists, be they large or small.

The inability on the part of Ceylonese agriculturists to appreciate the usefulness of Co-operative Societies for the common sale of produce or for the common purchase of agricultural requirements is rather surprising. The major agricultural industries of Ceylon are not, as is generally supposed, altogether in the hands of the large estate-owners. Out of some 20,000 acres under Cacao over 7,000 acres belong to the small-holders. Of 400,000 acres under rubber no less than 95,000 acres are in the hands of small owners cultivating 15 acres and less. The citronella industry which represents Rs. 2,130,000 of our annual exports is altogether in the hands of Ceylonese agriculturists, the majority of whom are small-holders. Of the area under tea, viz., 404,400 acres, about 9,000 acres belong to small-holders.

The above statistics will show that the small-holders' produce, if not well turned out and properly marketed, can, to a certain extent, mar the reputation of Ceylon as a producer country. The complaints received from foreign buyers about our recent shipments of citronella oil show that this is something more than a mere possibility. It has been found that the citronella oil exported from Ceylon during recent months has been adulterated to an alarming extent by the addition of cheap alcohol. It has also been found that the responsibility for this adulteration lies not with the producer or exporter but with the man who acts as intermediary between the two. Government inspection of oil before shipment and various other devices to prevent adulterated oil from leaving Ceylon have been suggested. A simple and less expensive method lies in the hands of the producers themselves: and that is to eliminate the middleman altogether by organising themselves into Co-operative Societies and dealing direct with the exporter. If producers can be made to do this, not only will an unadulterated oil reach the exporters' hands, but what is more important, the producer himself will get a better price for his oil.

Producers of Cacao, Tea and Rubber too stand to benefit by adopting the Co-operative method of selling produce. At the present moment, while large owners are selling their 1st grade cacao for Rs. 50·00 in Colombo, the small owners around Kandy, the centre of the Cacao industry, do not get a price higher than Rs. 15·00 for their product, although the quality is the same. A census taken by an officer of the Agricultural Department about a year ago showed that within a single month some 4,000 cwts. of village cacao had passed through the hands of the dealers in Katugastota. This cacao comes into the dealers' hands in lots of varying size and of varying

grades. To cover the cost of grading, losses in weight due to driage, and also possible losses due to market fluctuations the dealer gives the producer a price which is so low that it hardly pays the latter for his labour. It is fortunate that to the Ceylon villager time is not a thing of value ; otherwise a good many of our agricultural industries, e.g., paddy cultivation, would have long been abandoned, as the returns they bring are not in any way commensurate with the time and labour expended on them.

There is another reason why the Cacao grower fails to get a reasonable price for his produce. The harvesting of the annual crop takes place almost simultaneously in the cacao growing areas of the Island, and does not take more than a few months. The village producer, whose stock of cash is never great, shows a feverish anxiety to sell his produce immediately he gathers his crop. During this season, the middleman, on the other hand, is not at all keen to buy—at least not at anything like a reasonable price. It never enters the mind of the villager that when the supply of any commodity exceeds the demand at the time, the price is bound to drop. Thus by trying to sell his produce at a time when the market is glutted the producer loses the fruit of his toil.

A Co-operative Society alone can remove these disadvantages. In the first place it will buy the produce direct from the grower and before selling it will make every effort to grade the produce into the standard grades required by exporters. In the second place it will keep a careful eye on the market and learn to sell only when prices are good. The middleman too, no doubt, is guided by these principles. But the great difference between him and a Co-operative Society is this : whereas the middleman pockets the profits that he makes on the transaction, the Co-operative Society returns to its members whatever profits it makes.

The above remarks apply to growers of rubber and tea as well. Since the improvement in the tea market a large number of factories have sprung up in various parts of the Island. The owners of these, who do not possess an inch of cultivated land, depend altogether on what is termed "bought leaf," or in other words, leaf purchased from small growers. Although at present the prices for manufactured leaf fluctuate but rarely in Colombo, the prices paid for green leaf by these manufacturers vary from day to day the price being regulated entirely by the supply and the local demand. In some districts rings have been formed by the owners of factories to keep down prices. If the small producers can make up their minds to jointly sell their leaf in bulk to a Tea factory of repute, or arrange with the Factory to manufacture their leaf for them and effect the sale of the manufactured leaf on their behalf, the producers can expect to get at least a few cents more per pound than what they get under existing arrangements. Tea factories of repute undertake this kind of work for individual growers. How much more will they not do such work for Societies formed by small growers, when the cry all round is, that the quality of our teas should be maintained at a high standard if our hold on the world's markets is to be retained?

As stated at the outset Produce Co-operation has so far received no attention in Ceylon. The problems we have to tackle are not easy; but other agricultural countries like ours have had to face similar problems which have been successfully solved. Their experience is at our disposal and, therefore, the mistakes they have made we can avoid.

The modern Co-operative movement owes its origin to the action of the 12, now historic, Rochdale weavers who on a bleak winter evening in the year 1843 met together to devise ways and means to better their miserable position. At that meeting they decided to establish a provision store from which they could buy their bare necessaries. To find the requisite capital, each member agreed to contribute 2d. per week for a year. The

twelve members later increased to 28, and with some £28 which they managed to scrape together, they opened on 21st, December, 1844, a small shop, where only at first flour, sugar and butter were stocked. This tiny little seed has now sprung up and developed into a mighty big tree. To-day there are in England 2,500 retail distributive Societies with a membership of 2,500,000 and an annual turnover of £111,000,000. The Co-operative Wholesale, which supplies the major requirements of these Societies, has alone a turnover of £43,000,000. The Rochdale Society adopted certain rules which are now considered to be essential for the successful working of a Co-operative Society. They were: (a) Payment of a fixed remuneration on capital, (b) Sales at market prices and (c) Distribution of profits in proportion to the amount of purchases made by a member and (d) each member one vote.

The Co-operative movement in England was, till recent years, confined to the towns. But in other countries, to which the idea was carried, the reverse has taken place. For instance, in Denmark, repeated efforts to establish Distributive Co-operative Societies in the towns failed. On the other hand the idea was enthusiastically taken up by the farmers and the present prosperity of Danish agriculture is altogether due to the enthusiasm with which the small farmers took to Co-operation.

Up to about 1880 peasant butter in Denmark came to the market in such small quantities, that were it ever so good, it was useless for export. Just as our village cacao growers do at present, the Danish small-holders handed over their home-made butter to the butter merchants, who graded, milled and exported it. Even the finest peasant butter at this time realised less than the butter produced by the large estate owners, because it did not reach the merchants in a marketable condition.

The Co-operative dairy enabled the small-holders to get over these difficulties. The practice of manufacturing butter in their own cottages was discontinued. The small-holders' milk was collected and converted into butter at a central Co-operative Dairy and payment was made for the milk supplied according to its fat content. The profits made by the Co-operative Dairy were distributed to the members at the end of a specified period in proportion to the value of milk supplied by them.

Within a short period the butter produced by the Co-operative Dairies was found to be even superior to that produced in the large estates. "The advantage these Co-operative Dairies had over private dairies was that the man who supplied the milk was interested in the result. He therefore took care to supply to the dairy good milk and also saw to it that his neighbour did the same." In 1882 there were only two Co-operative Dairies in Denmark. In 1888 they had increased to 489. At the end of 1914 the figures were as follows :—

Co-operative Dairies	1168
Private Collective Dairies	196
Estate Dairies	16

With the improvement in the quality of the butter produced by the Co-operative Dairy Societies there was a marked increase in uniformity. The result was that foreign buyers were willing to pay for Danish Co-operative butter a higher price owing to its uniformity. Thanks to the Co-operative Dairy the small-holder with one cow was able to get the same price for his milk as his richer neighbour who owned hundreds.

The following figures show what rapid progress the dairy industry has made in Denmark since the organisation of Co-operative Dairies in that country.

Yearly Average.	Tons of Butter exported.
1881-85	15,630
1886-90	29,730
1891-95	48,070
1896-1900	57,396
1901-1905	76,044
1906-1910	90,180
1911-1915	99,420

The principles on which a Co-operative Dairy is organised are these :

(*a*) Members bind themselves to deliver to the dairy all the milk they produce;

(*b*) all are jointly and severally liable;

(*c*) the proceeds are divided in proportion to the amount of milk delivered by each;

(*d*) all milk producers can be members without any contribution in cash.*

The Co-operative egg-collecting Societies of Denmark, the Co-operative fruit exchanges of California are other types of Co-operative Societies which can be used as models by us in organising societies for marketing our agricultural products.

In Denmark, the intial capital required by a Co-operative Society is borrowed generally from a bank on the joint liability of members. The exchange banks of Ceylon are not likely to undertake this kind of business; neither have we yet in Ceylon Co-operative Central banks for financing Co-operative undertakings. The capital required for a Co-operative Society will, therefore, have to come partly from the members themselves and partly from the State. This is the present arrangement under which our credit Societies obtain their working capital.

Is there not a great similarity between the dairy industry of Denmark and some of our agricultural industries? Are the principles which have held good in the case of the Dairy Industry not applicable to some of these industries? The citronella industry is the one that suggests itself first. At present the small grower sells his grass to the private distiller or the latter distils the oil for the producer on a share basis, the distillers' share being usually one-sixth of the oil produced. These distilleries are on the one hand not very efficient and up to date. On the other hand their owners run them as profit-earning concerns and therefore pay as little as possible to the grower for his grass. If Co-operative citronella distilleries, modelled after the Danish Co-operative Dairies, can be organised a great improvement can be effected in the quality of the oil. Higher prices too could be paid to the producer who will share the profits in proportion to the amount of grass he supplies to the distillery. The Middleman, who is said to be responsible for the adulteration of oil, could be eliminated because the output of a co-operative distillery would be large and therefore direct dealing with exporters is quite easy.

At present the small-holders' rubber comes to the market invariably in the form of rubber sheet. These are neither uniform nor well turned out. They do not fetch a fraction of what the factory-made crepe rubber fetches. Is there no possibility of establishing in the more prosperous rubber districts, where the small-holders predominate, Co-operative factories for purchasing latex direct from the small-holders and converting it into crepe rubber ?

Co-operative Societies for marketing the small-holders' cacao as well as unmanufactured tea leaf have also a very good chance in Ceylon.

"A Co-operative Society must be a child of necessity." A society has no chance of success unless its usefulness in a locality can easily be demonstrated. The Ceylon villager, like his brother in other parts of the world, is conservative and is slow to take up a new idea. But once a practical scheme is put before him by people, whose sincerity he has no reason to doubt, his support is assured. To do this we want men who believe more in work and less in talk.

* Vide "Co-operation in Danish Agriculture" by H. FABER.

MARKET RATES.

MARKET RATES FOR SOME CEYLON PRODUCTS.

(FROM THE CEYLON CHAMBER OF COMMERCE WEEKLY PRICE CURRENT, DATED 17th MARCH, 1924.)

NAME OF PRODUCE		CURRENT PRICE			REMARKS
		Rs. cts.	at	Rs. cts.	
CARDAMOMS					
All round parcel well bleached	per lb.	...		...	
Do do medium	do	3 25	,,	3 50	
Special assortment O & I only	do	...	,,	...	
Seeds	do	3 50	,,	3 70	
Green	do	2 50	,,	3 00	
CINNAMON QUILLS—[At Buyer's Stores]					
Ordinary assortment (in bales of 100 lb. nett)	per lb.	0 59	,,	0 64	
No. 1	do	0 61	,,	0 66	
No. 2	do	0 59	,,	0 64	
No. 3	do	0 57	,,	0 62	
No. 4	do	0 55	,,	0 60	
CINNAMON CHIPS—Maradana, (At Buyer's Stores) (in bags of 56 lb. nett) per candy of 560 lb.		52 50	,,	62 50	
CITRONELLA OIL—(ex-Seller's Stores without packages)	per lb.	2 10		2 20	
CACAO—(At Buyer's Stores)					
Estate—Finest	per cwt.	53 00	,,	57 00	
Do Medium	do	28 00	,,	50 00	
Do Common (Black)	do	10 00	,,	20 00	
COCONUT—(Desiccated) Granulated goods (Delivered at Wharf or Buyer's Stores)					
Assortment: Medium 50 per cent, Fine 50 per cent.	per lb.	0 22	,,	0 24	
COCONUT OIL—					
White Oil f.o.b	per ton	612 50	,,	635 00	
Ordinary Oil do	do	580 00	,,	592 50	
COPRA—					
Calpentyn — No. 1 quality per candy of 560 lb.		88 00	,,	91 50	
Estate — do 560 ,,					
Ordinary quality (Marawila) — do 560 ,,					
Cart Do do — do 560 ,,					
FIBRES—(At Buyer's Stores)					
Coconut Bristle No. 1	per cwt.	12 75	,,	14 35	
Do No. 2	do				
Coconut Mattress No. 1	do	2 75	,,	3 00	
Do No. 2	do				
Coir yarn Kogalla No. 4 to 9	do	12 00	,,	25 00	
Do Colombo No. 3 to 7	do	12 00	,,	25 00	

PLUMBAGO		X. B.			B			B. E.		
		Rs. cts.		Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.		Rs. cts.
Ordinary Lumps	per ton	300 00	at	350 00	215 00	at	250 00	150 00	at	185 00
Chips	do	175 00	,,	250 00	130 00	,,	200 00	100 00	,,	150 00
Dust	do	100 00	,,	175 00	70 00	,,	125 00	40 00	,,	75 00
Do Flying	do	60 00	,,	145 00	40 00	,,	90 00	25 00	,,	60 00

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 31st MARCH, 1924.

Province, &c.	Disease	No. of Cases up to date since Jan 1st, 1924	Fresh Cases	Recoveries	Deaths	Balance Ill	No. Shot
Western	Rinderpest	220	87	53	139	23	5
	Foot-and-mouth disease	3	—	3	—	—	—
	Anthrax	—	—	—	—	—	—
Colombo Municipality	Rinderpest	236	60	22	155	59	—
	Foot-and mouth disease	—	—	—	—	—	—
	Anthrax	—	—	—	—	—	—
	Rabies	—	—	—	—	—	—
Cattle Quarantine Station	Rinderpest	3	—	2	1	—	—
	Foot-and-mouth disease	8	8	7	1	—	—
	Anthrax	75*	22	—	75	—	—
	* 2 cases amongst cattle						
Central	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	—	—	—	—	—	—
	Anthrax	3	1	—	3	—	—
	Piroplasmosis	4	1	—	—	4	—
Southern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	2	1	2	—	—	—
	Anthrax	—	—	—	—	—	—
Northern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	—	—	—	—	—	—
	Anthrax	—	—	—	—	—	—
	Hæmorrhagic Septicæmia	97*	64	2	86	9	—
Eastern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	1	—	1	—	—	—
	Anthrax	—	—	—	—	—	—
North-Western	Rinderpest	243	3	91	144	3	5
	Foot-and-mouth disease	25	—	25	—	—	—
	Anthrax	—	—	—	—	—	—
	Rabies	1	1	—	—	—	1
North-Central	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	78	78	60	—	18	—
	Anthrax	—	—	—	—	—	—
Uva	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	—	—	—	—	—	—
	Anthrax	3	3	—	3	—	—
Sabaragamuwa	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	76	—	76	—	—	—
	Anthrax	6	6	—	6	—	—
	Hæmorrhagic Septicæmia	3	3	—	3	—	—
	Rabies	1	1	—	1	—	—

a 23 cases amongst goats

Colombo, 7th April, 1924.

G. W. STURGESS,
Government Veterinary Surgeon.

METEOROLOGICAL

MARCH, 1924.

Station	Temperature: Mean Daily Shade	Temperature: Difference from Average	Mean Humidity	Mean amount of Cloud 0=clear 10=overcast	Mean Wind Direction during Month	Daily Mean Velocity	Rainfall: Amount	Rainfall: No. of Rainy Days	Rainfall: Difference from Average
	°	°	%			Miles.	Inches		Inches
Colombo Observatory	81·4	0	78	5·4	Var.	89	11·29	12	+7·20
Puttalam	81·0	- 0·2	76	4·0	NNE	127	8·01	13	+5·15
Mannar	82·6	- 0·4	75	4·6	NNE	191	4·08	8	+2·70
Jaffna	82·0	- 0·8	72	4·4	ENE	85	2·80	9	+1·69
Trincomalee	81·6	- 1·0	75	5·3	ENE	143	8·23	12	+6·71
Batticaloa	80·0	- 0·8	79	4·9	NNE	142	11·91	15	+9·04
Hambantota	80·8	+0·4	82	4·2	ENE	227	8·49	15	+6·31
Galle	80·4	- 0·7	84	5·3	Var.	117	8·79	15	+4·52
Ratnapura	82·4	+0·2	76	5·8	—	—	20·82	22	+12·24
Anu'pura	80·6	- 1·4	76	5·0	—	—	4·73	10	+2·05
Kurunegala	82·5	- 0·4	71	5·3	—	—	3·99	9	-10·92
Kandy	78·5	+0·1	72	5·0	—	—	5·86	15	+2·00
Badulla	73·4	0	80	6·4	—	—	8·66	16	+4·32
Diyatalawa	67·8	0	74	6·8	—	—	4·47	16	+0·47
Hakgala	60·8	+0·6	82	6·6	—	—	10·96	17	+5·74
N.' Eliya	60·6	+1·5	78	6·4	—	—	7·66	16	+4·34

Air Pressure was slightly higher to the North than in the South and so accounted for the northerly tendency in the wind experienced over the Island. For March, though the wind was slightly above the average in velocity it was not strong enough to prevent local convectional winds, which winds were strongly marked. With land and sea breezes dominant thunderstorms were rife.

Over the Island, generally, the weather during the first ten days was fine and bright. For the remainder of the month the mornings were mostly fine and bright with heavy clouding or thunderstorms later in the day

Except for the district to the Northeast of the hills, between East and South of Anuradhapura down to and including Kurunegala, where the rainfall in amount was less than the average, the rainfall for the Island was above the average both in quantity and in the number of rainy days experienced.

Rainfall was well distributed during the latter part of the month but no very excesive falls were recorded; Of the ten stations reporting over five inches of rain during the 24 hours Tanamalwila with 5.80 inches and Denagama with 5 75 head the list. Precipitation was heaviest between the coast and to the South and West of the Hills

For Ceylon, the barometer from the 23rd to the 29th was almost phenomenally low and it was about this period that the thunderstorms were most numerous.

Clouding was slightly above normal.

Humidity to the South and Southwest was normal, above normal up-country and below t the North and East.

The temperature did not vary much from the average but what differences there were practically followed the distribution of Humidity.

J. E. EVANS,
Supdt., Observatory.